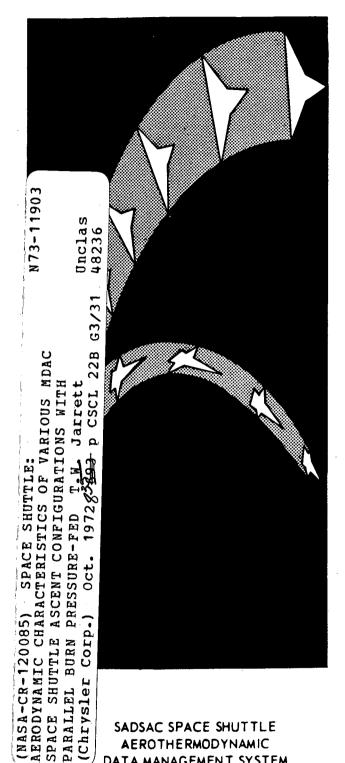
Lee Luis

DMS-DR-1230 CR-120,085 OCTOBER 1972



-SPACE SHUTTLE-

AERODYNAMIC CHARACTERISTICS OF VARIOUS MDAC SPACE SHUTTLE ASCENT CONFIGUR-ATIONS WITH PARALLEL BURN PRESSURE-FED AND SRM BOOSTERS

VOLUME III TANK T4 CONFIGURATIONS

by

T. W. Jarrett, MDAC

MDAC 4-FOOT TRISO WIND TUNNEL

CONTRACT NAS8-4016 MARSHALL SPACE FLIGHT CENTER

AEROTHERMODYNAMIC DATA MANAGEMENT SYSTEM



This document should be referenced as NASA CR-120,085

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DMS-DR-1230 VOLUME III CR-120,085 OCTOBER, 1972

SADSAC/SPACE SHUTTLE

WIND TUNNEL TEST DATA REPORT

CONFIGURATION:	MDAC Pressure Fed and SRM Parallel Burn Ascent Configurations
TEST PURPOSE:	To Define the Aerodynamic Characteristics of an Ascent
	Configuration, the Individual Component Contribution,
	Relative Orbiter and Booster Position and Interference Effects
TEST FACILITY:	MDAC Aerophysics Lab. 4 Foot Trisonic Wind Tunnel
TESTING AGENCY:	MDAC (W)
TEST NO. & DATE:	S-222; 2 Dec. 1971 - 18 Jan. 1972, 25 Jan. 1972 - 8 Feb. 1972
FACILITY COORDINA	TOR: T. W. Jarrett, MDAC
PROJECT ENGINEER	S): T. W. Jarrett, MDAC
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forTo L.	Mulkey W. R. Morgan
DET I	LASE APPROVAL: Q. Y. Bl.
KELI	(N. D. Kemp, Supervisor
	Aero Thermo Data Group

CONTRACT NAS 8-4016

AMENDMENT 174

DRL 297-84a

This report has been prepared by Chrysler Corporation Space Division under a Data Management Contract to the NASA. Chrysler assumes no responsibility for the data presented herein other than its display characteristics.

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AERODYNAMIC CHARACTERISTICS OF VARIOUS MDAC SPACE SHUTTLE ASCENT CONFIGURATIONS WITH PARALLEL BURN PRESSURE-FED

AND SRM BOOSTERS (M = 0.4 - 4.5)

By

T. W. Jarrett

INTRODUCTION

Various space shuttle ascent configurations were tested in the MDAC Aerophysics 4 x 4 Ft. Trisonic Wind Tunnel. The models were 0.6 percent scale. The ascent configurations consisted of a NASA/MSC 040A orbiter in combination with various HO centerline tank and booster geometries. The purposes of the tests were to determine the aerodynamics of the ascent configurations, the aerodynamic interference between components and its effect on orbiter aerodynamics, and to determine orbiter aileron effectiveness.

The model was sting mounted with either a single internal balance (in the orbiter HO tank) or dual internal balances (one in the orbiter and one in the orbiter HO tank). With the dual balance setup, three types of runs were made; one with tank alone on the tank balance, one with tank and two attached boosters on the tank balance, and one with the tank and one booster attached on the tank balance and the other booster isolated on a separate sting but in proximity to the tank and orbiter. In addition to the 6-component force and moment balance data, base pressure data were taken for the boosters, the tank and the orbiter. Angle of attack data included α sweeps at 0° and 6° β (the latter involving a knuckle change) and β sweeps at 0° and 6° α . Through the use of a remote roll device it was usually possible to get both an α sweep and a β sweep in a single run.

INTRODUCTION (Continued)

The report consists of five volumes arranged in the following manner:

Volume I	Ascent configurations with centerline HO tanks T_1 and T_2
Volume II	Ascent configurations with centerline HO tank T_3
Volume III	Ascent configurations with centerline HO tank $T_{l_{\downarrow}}$
Volume IV	Ascent configuration plume studies and configuration buildup
Volume V	Orbiter alone, Tanks alone and Boosters alone

NOMENCLATURE General

SYMBOL	SADSAC SYMBOL	DEFINITION
8		speed of sound; m/sec, ft/sec
Сp	CP	pressure coefficient; $(p_1 - p_{\infty})/q$
М	MACH	Mach number; V/a
р		pressure; N/m ² , psf
P	Q(NSM) Q(PSF)	dynamic pressure; $1/2\rho V^2$, N/m^2 , psf
R N/ L	RN/L	unit Reynolds number; per m, per ft
V		velocity; m/sec, ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI ·	angle of yaw, degrees
φ	PHI	angle of roll, degrees
ρ		mass density; kg/m^3 , $slugs/ft^3$
	<u>R</u>	eference & C.G. Definitions
$A_{\mathbf{b}}$		base area; m ² , ft ²
b	BREF	wing span or reference span; m, ft
c.g.		center of gravity
$oldsymbol{\ell}_{ ext{REF}}$	LREF	reference length or wing mean aerodynamic chord; m, ft
S	SREF	wing area or reference area; m^2 , ft^2
	MRP	moment reference point
	XMRP	moment reference point on X axis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis
SUBSCRIP b l s t	<u>rs</u>	base local static conditions total conditions free stream

NOMENCLATURE (Continued) Body-Axis System

SYMBOL	SADSAC SYMBOL	DEFINITION
c_{N}	CIN	normal-force coefficient; normal force
c_A	CA	axial-force coefficient; axial force
$\mathbf{c}_{\mathbf{Y}}$	CY	side-force coefficient; $\frac{\text{side force}}{q^S}$
$^{\text{CA}}_{\text{b}}$	CAB	base-force coefficient; base force qS
		$-A_b(p_b - p_{\infty})/qS$
$\mathtt{c}_{\mathtt{A_f}}$	CAF	forebody axial force coefficient, C_A - C_{A_b}
$C_{\mathbf{m}}$	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{\text{qS}I_{\text{REF}}}$
C_n	CYN	yawing-moment coefficient; yawing moment qSb
c l	CBL	rolling-moment coefficient; rolling moment qSb
		Stability-Axis System
$c_{\mathbf{L}}$	CL	lift coefficient; lift qS
CD .	CD	drag coefficient; drag qS
c_{D_b}	CDB	base-drag coefficient; base drag
$\mathbf{c_{D_f}}$	CDF	forebody drag coefficient; C_{D} - $C_{\mathrm{D}_{\mathrm{b}}}$
$C_{\mathbf{Y}}$	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_{m}	CLM	pitching-moment coefficient; pitching moment qs/REF
c_n	CLN	yawing-moment coefficient; yawing moment qSb
c[CSL	rolling-moment coefficient; rolling moment qSb
r/D	L/D	lift-to-drag ratio; $c_{ m L}/c_{ m D}$

ADDITIONS TO NOMENCLATURE

SYMBOL	SADSAC SYMBOL	DEFINITION
$\mathtt{C}^{\mathbf{\Gamma}}_{S}$	CLSQR	lift coefficient squared.
ða	AILRON	aileron, total aileron deflection angle, degrees, (left aileron-right aileron)/2.
∂ e	ELEVON	elevon, surface deflection angle, positive deflection, trailing edge down; degrees.
6 _r	RUDDER	rudder, surface deflection angle, positive deflection, trailing edge to the left; degrees
∂ rf	RUDFLR	rudder flare, split rudder deflection angle, left split rudder trailing edge left and right split rudder trailing edge right, $\delta_{rf} = (\delta_{rL} + \delta_{rR})/2$, positive deflection; degrees.

CONFIGURATIONS INVESTIGATED

The wind tunnel models were 0.6 percent scale models and included one orbiter configuration, four tank configurations, and seven booster configurations. The orbiter centerline HO propellant tanks included variations in diameter (302 and 325 in.), nose cone angle (10° and 15°), and axial position (120 inch travel). Of the boosters, three were solid rocket motors with the remainder being pressure fed boosters. The pressure fed boosters included variations in diameter (206 and 248 inch), nose cone angle (15° and 20°) and base flare (5° and 15°). The solid rocket motors included variations in diameter (156 and 120 in.) and base flare (0° and 15°) for the 156 in. motor.

In addition, simulated rocket plumes were tested at M=1.5 and 2.2 for both pressure fed and solid rocket motor boosters. These plumes were made up of three solid aluminum bodies each of which represented an envelope of individual engine plumes for the orbiter and each booster. These envelopes were generated by taking the outermost plume boundary of the outermost engine for each component and rotating this boundary about the null thrust vector of the component (orbiter or booster). The individual engine plumes were generated at MSC with the plume boundary defined by a method of characteristics solution with the flow field originating at the exit plane, and the effects of the external flow on the boundary calculated by Newtonian impact theory.

The contours of the various plumes tested are defined in Table 4 and Figure 43 through 46. The matrix of plume testing was as follows:

CONFIGURATION	BOOSTER PLUME	ORBITER PLUME	$\frac{M_{\mathrm{TEST}}}{2}$
OlTlBl	LOX/PROP M = 2.5	4 ENG. J2S M = 2.5	2.2
OlTlBl	LOX/PROP M = 1.5	3 ENG. HiPc $M = 1.5$	1.5
$O_1T_1B_1$	LOX/PROP M = 1.5	3 ENG. HiPc $M = 1.5$	2.2
0 ₁ T ₃ B ₆	156" SRM M = 1.5	3 ENG. HiPc $M = 1.5$	1.5
0173B6	156" SRM M = 2.2	3 ENG. HiPc $M = 2.2$	2.2
0 <u>1</u>	120" SRM M = 1.5	3 ENG. HiPc M = 1.5	1.5
0 <u>1</u> T4B7A <u>1</u> -4	120" SRM M = 2.2	3 ENG. HiPc M = 2.2	2.2

Symbols for Orbiter Configuration:

Symbol	Description
Ol Wl Bl El Vl V2 V _{OFF}	WlBlElV2R2PlMlCO Wing Body Elevon Centerline vertical (Replaces V2R2) Centerline vertical No centerline vertical
CO R1 R2 P1 M1 C1 C2	Canopy Rudder for Vl Rudder for V2 ACPS Engine Pod OMS Engine Pod Cupola Canopy Off (Replaces CO)
Symbols for Tanks	
Symbol	Description
т ()	Tank complete
T ()a	Tank complete at an alternate position with respect to the boosters and orbiter
Fl	Fin for T_{l_4}
Symbols for Boosters:	
Symbol	Description
B () S F ¹ 4 A	Boosters complete Skirt for booster Fins for B ₁ Thrust vectoring fuel tank for B ₇
Symbols for Plumes:	
Symbol	Description
+ Plume (2.5)	3 Plumes (Orbiter + 2 Boosters) at M = 2.5
+ Plume (1.5)	3 Plumes (Orbiter + 2 Boosters) at M = 1.5
+ Plume (2.2)	3 Plumes (Orbiter + 2 Boosters) at M = 2.2

TEST FACILITY

The MDAL 4' Trisonic Wind Tunnel facility is a blowdown type operation capable of Mach numbers of 0.2 to 5.0 and Reynolds numbers from approximately 1 x 10⁶ to 2 x 10⁶ per inch. The subsonic and transonic Mach numbers are run in a porous wall test section which is removed for supersonic testing. The supersonic test section utilizes a two dimensional flexible plate nozzle to obtain Mach numbers 1.5 to 5.0. The models are mounted on a sting that is supported from a vertical translating strut with a vertical plane rotating pod having a pitch range of -15^o to +25^o when no offset adapters are present.

MODELS AND SUPPORT EQUIPMENT

The test models with all of their interchangeable component parts were 0.60 percent of full scale.

The orbiter model had a blended body contoured into a low delta wing. Effects of orbiter position and booster relative to the tank was investigated at two longitudinal locations on the tank (nominal and aft). The orbiter and boosters can be bolted to the tank (T1) in both nominal and aft positions as well as independently mounted from the tank. For the bolted orbiter case, the orbiter balance was inoperative and there were no force or moment data for the orbiter.

Effects of the orbiter control surfaces and control surface deflections were investigated for elevons, ailerons, and rudder with the surfaces deflected and undeflected.

Transition strips of No. 120 carborundum grit were used to insure boundary layer transition from laminar to turbulent flow. These strips were 3/32 inches wide and were located 3/4 inches aft of the orbiter nose, 1/2 inch aft of the booster nose, 1/2 inch aft of the tank nose, and at 5 percent local chord (both surfaces) on the wings, vertical tails and fins.

To achieve the required test angles of attack and sideslip two straight balance adapters were used in combination with the MDAL 6 degree sting adapter. A straight sting section positioned the model properly in the test section.

Pressure data for the orbiter, tank or the booster were obtained from base and balance cavity pressure pickups that were cantilevered off the sting. Leads for these pickups were routed externally over the model support system and into the tunnel strut. The boosters in the presence of the tank each had a base pressure pickup.

DATA REDUCTION

The data are corrected for such factors as model tares, sting bending and balance deflections, interactions, and bilinearities.

Composite Configurations

- 1. The orbiter data were reduced about the orbiter MRP using its reference dimensions and about the tank MRP, using orbiter reference dimensions (ā for longitudinal and b for lateral).
- 2. The tank data were reduced about the tank MRP using orbiter reference dimensions (c for longitudinal and b for lateral).
- 3. A <u>summation</u> of the orbiter (tank MRP) and tank (tank MRP) data with all data corrected for angular attitudes to the tank body axes.

Orbiter Alone Configurations

1. The orbiter data were reduced about the orbiter MRP using the orbiter reference dimensions (c̄ for longitudinal and b for lateral).

Tank Alone Configurations

1. The tank data were reduced about the tank MRP using the orbiter reference dimensions.

Booster Alone Configurations

1. The booster data were reduced about the booster MRP using the orbiter reference dimensions.

Ascent configuration composite tank MRP data, orbiter alone data, tank alone data and booster alone data are presented in this report, with the remaining data on file and available upon request.

Reference quantities used in these data reductions are as follows:

ORBITER

Quantity	Full Scale Dimensions _(Reference only)	Model Dimensions
Reference Area (S)	3155.3 Ft ²	16.37 In ²
Reference Span (b)	882 In.	5.292 In
Reference MAC (c)	609.5 In.	3.657 In
Moment Reference Points		See Figures 13 & 14

DATA REDUCTION (CONTINUED)

Areas:		
Total Base (AB)	298 Ft ²	1.546 In ²
	TANK	
Quantity	Full Scale Dimensions (Reference only)	Model Dimensions
Reference Area (S)	3155.3 Ft ²	16.37 in ²
Reference Length (b)	882 In.	5.292 in.
Reference Length (c)	609.5 In.	3.657 in.
Moment Reference Points		See Figures 13 & 15
Areas:		
Total Base (AB)/Tank	Tl - 422 Ft ²	2.125 In ²
	T2 - 422 Ft ²	2.125 In ²
	T3 - 518 Ft ²	2.613 In ²
	T4 - 537 Ft ²	2.785 In ²
	BOOSTER	
Quantity	Full Scale Dimensions (Reference only)	Model Dimensions
Reference Area (S)	3155.3 ft ²	16.37 in ²
Reference Length (b)	882 in.	5.292 in.

609.5 in.

Reference Length (c)

Moment Reference Points

3.657 in.

See Figures 13 & 16 through 19

DATA REDUCTION (CONTINUED)

Areas:

Total Base (AB)/Booster	Bl	-	901.0 Ft ²	4.539 In ²
.*	BlSl	-	2125 Ft ²	11.0093 In ²
	BlS2	-	4785 Ft ²	24.7887 In ²
	B 2	-	137.8 Ft ²	0.694 In ²
	B2S	_	428 Ft²	2.158 In ²
	В3	-	902 Ft ²	4.545 In ²
	B ¹ 4	-	568 Ft ²	2.865 In ²
	B 5	-	557 Ft ²	2.883 In ²
	в6	_	95.4 Ft ²	0.481 In ²
	В7	_	79.3 Ft ²	0.408 In ²

TABLE 1.

TEST CONDITIONS
TEST S-222

MACH NUMBER	REYNOLDS NUMBER per (inch)	DYNAMIC PRESSURE (pounds/sq. inch)	STAGNATION TEMPERATURE (degrees Fahrenheit)
0.4	0.50 x 10 ⁶	3.3	53
0.6	0.83 x 10 ⁶	7.6	47
0.7	0.74 x 10 ⁶	7.8	68
0.9	0.79 x 10 ⁶	10.0	50
0.95	0.67 x 10 ⁶	8.8	53
1.05	0.69 x 10 ⁶	9.5	50
1.1	0.69 x 106	9.8	52
1.5	0.63 x 10 ⁶	10.0	55
2.2	0.63 x 10 ⁶	9.9	68
2.25	0.94 x 10 ⁶	14.0	52
2 . 5	0.66 x 10 ⁶	10.3	91
4.5	1.15 x 10 ⁶	10.6	120
		:	

BALANCE UTILIZED: See	Listing on next page.	· · · · · · · · · · · · · · · · · · ·
CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF		
SF	<u> </u>	
AF		
PM		
YM		
RM		
		

COMMENTS:

TABLE 1.

TEST CONDITIONS (CONTINUED)

BALANCES UTILIZED

Several balances were required during the test. Listed below are the balances used, their capacity and the corresponding tunnel runs which apply to each.

BALAN	CES
-------	-----

	Orbiter 3/4" D.	Tank Balance
Runs 1-10 Runs 11-113 Runs 114-184 Runs 185-197 Runs 198-270 Runs 271-420 Runs 421-424 Runs 425-459 Runs 460-474 Runs 475-569 Runs 570-646	#7 DAL - #5 DAL - #58 DAL #58 DAL #58 DAL	#13 NAR #13 NAR #13 NAR #13 NAR #13 NAR #11 DAL #11 DAL #11 DAL #11 DAL #11 DAL #11 DAL

Balance	MK. 3LA 3/4" D.#7 DAL	MK. 2A 3/4" D.#5 DAL	MK. 10 3/4" D.#58 DAL	MK. 7 1" D.#13 NAR	MK. 3C 1" D. #11 DAL
Gage	<u> </u>	31: 2: 112 2-2	Capacity		
NF (each) 2 gages	100 lb.	100 lb.	100 lb.	500 lb.	250 lb.
SF (each) 2 gages	100 lb.	50 lb.	100 lb.	300 lb.	250 lb.
AF	80 lb.	25 lb.	50 lb.	500 lb.	150 lb.
RM	20 in.lb.	60 in.lb.	40 in.1b.	150 in.lb	. 150 in.1b.

ORBITER @ ORBITER MRC

(\$1) ORBITER ISOLATED ON SEPARATE BALANCE.
(BXX) BOUSTER ISOLATED
WITHOUT A BALANCE.

POSTTEST PRETEST

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PRETEST

TABLE 2.

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				403	4		404	405		ω		10	0	0	0		. 54/
				400	4		402	401		w		0	0	1 20	0 7	•	144
				8	400		402	401		W		0	0	20	A 0		143
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				BERS	MACH NUMBERS	VW				NO.	CONTROL DEFLECTION	DEFL	TROL		SCHD.		DATA SET
POSTTEST	D Pos						** 17 •	7		ê							

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CONFIGURATION SCIII). CONFIGURATION A B S A SE SC CONFIGURATION A SE SC																
CURATION (CONTROL DEFLECTION) (CONTROL NUMBERS	CONFEGURATION CONTROL DEFLECTION MO. (\$\frac{1}{2}\fr	1) TDPVAF	Topvar		·										1	ENTS:	FRETCT
CURATION CONTROL DIFFLECTION NO. CONTRO	CONFIGURATION CONFIGURATION CONFIGURATION MO. CONFIGURATI	67	61		5.5	6 4)	3	+	37		i	2.5		3			
CUBATION CONTROL DEFLECTION of Factors of Price of Prices MACH NUMBERS MACH NUMBERS 72.855 0. D. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	CONFIGURATION CONTROL DEFLECTION No. NACH NUMBERS	314	3/3		327	_	328		4	,	0	0	0		B/R		180
COURATION CONTROL DEFLECTION of Control Not Control of Contr	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	311							(0		Ö	0	0	 			179
CURATION CONTROL DEFLECTION NO. CONTROL NUMBERS T2 # 5	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				3.36		335		N	-	0	0	0				178
CURATION SCIII. CONTROL DEFLECTION NO. ACH NUMBERS 7285 6 D 54 52 RUNS 04 6 6 9 64 67 64 67 67 67 67 67 67 67 67 67 67 67 67 67	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	280			336		335		4		0	0	0	 		73	177
CURATION SCIII. CONVINOL DEFLECTION NO. MACH NUMBERS 7.2.85 6.7 \$\frac{4}{2}\frac{1}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\fr	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	3/0	303	_					h '		0	0	0			*	176
CURATION SCHID CONTROL DEFLECTION NO. NO. MACH NUMBERS 7.2.85 6.7 5.4 5.2 3.25 7.2.85 6.7 5.4 5.2 3.3 408 407 405 1.1 1.5 2.2 2.25 7.2.4 85 A 6.7 0.0 0.0 3 408 407 406 1.1 1.5 2.2 2.25 7.2.4 87 6.4 0.0 0.0 0.0 3 409 400 4	CONFIGURATION SCILL. CONTROL DEFLECTION MO. A B SA SE SC RUNS OP O C S 3 HOS HOS NOBERS OP O C S 4 HOS HOS NOBERS OP O C S				332	·	330	334	W		0	a	0	 			Z
CURATION SCIID. ON TROIT DEFLECTION NO. NO. NACH NUMBERS 772 385 6 D 6 A <td< td=""><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td><td>279</td><td></td><td>277</td><td>33)</td><td></td><td>329</td><td>333</td><td>6</td><td></td><td>0</td><td>0</td><td>0</td><td></td><td></td><td>Į.</td><td>174</td></td<>	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	279		277	33)		329	333	6		0	0	0			Į.	174
CURATION SCHID. ONITROL DEFLECTION of a B $\frac{1}{3}$	CONFIGURATION CONFI				369		368		12		0	0	-	 		·	133
CURATION SCHID. (CONTROL DEFLECTION) NO. NO. MACH NUMBERS 772 355 6 \overline{D} 5 \overline{A} \overline{JE} \overline{JE} $\overline{COMTROL}$ NO. $\overline{COMTROL}$ NO.	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				369		3.5		2		0	0	0	 			172
CURATION CONTROL DEFLECTION NO. PROLETION NO. PROCESSA NO. PROPERTY NO. PROPER	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $,		36		367		10		a	0		 	-	*	171
CURATION SCIID. CONTROL DEFLECTION of	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	-			7.98.		367		N		Ö	0	0	 		(\$1) TZ	170
CURATION SCIID. CONTROL DEFLECTION of soft o	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		2/2						`		0	0	0		BIR	(\$1)TZA (B)	169
CURATION SCIID. CONTROL DEFLECTION NO. NO. PACH NUMBERS 772 355 6 D 5 A $4E$ <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td></td> <td>213</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td></td> <td>(BIR)</td> <td>72A</td> <td>160</td>	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		213								0	0	0		(BIR)	72A	160
CURATION SCIID. CONTROL DEFLECTION NO. NO. PACH NUMBERS 72 \$5 0 S SA SE SR	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		2/0						N	:	0	0	0			4	167
CURATION SCIID. CONTROL DEFLECTION NO. NO. WACH NUMBERS 97.2 3.5 0 0 3.4 3.5	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				412		4/3	414	W	<u> </u>	0	0	0				166
CURATION SCIID. CONTROL DEFLECTION NO. MACH NUMBERS 0 0 5A JE JE JE OH 0.6 0.7 0.75 1.05 1.1 1.5 2.2 2.25 7.2 8.5 0 D 0 0 0 3 408 407 406 1.1 1.5 2.2 2.25 1 7.2 8.5 A 0 0 0 0 3 408 407 406 407 406 407	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				412		413	414	W		0	0	0				29
CURATION CONTROL DEFLECTION NO. CONTROL DEFLECTION NO. CONTROL DEFLECTION NO. CONTROL DEFLECTION NO. OF O. O. O. O. O. O. O. O.	CONFIGURATION $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		211						<u> </u>		0	0	0	-	\) TZA	164
CURATION SCHOL CONTROL DEFLECTION NO. α B $\frac{1}{2}A$ $\frac{1}{2}E$ $\frac{1}{2}A$ of $\frac{1}{2}A$ $\frac{1}$	CONFIGURATION SCHU. CONTROL DEFLECTION NO. α 8 \overline{A} $\overline{J}E$ $\overline{J}R$ Of Sequence of the				4//			404	W		0	0	0	 -	_		163
CURATION SCHEL CONTROL DEFLECTION NO. $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	CONFIGURATION SCHU. CONTROL DEFLECTION NO. MACH NUMBERS $\frac{\alpha \beta \cancel{\xi_A} \cancel{\xi_E} \cancel{\xi_R} \text{of} \cancel{O.4} \cancel{O.6} \cancel{O.4} \cancel{O.45} \cancel{I.05} \cancel{I.1} \cancel{I.5} \cancel{2.2} \cancel{2.25}}{\cancel{O.17} \cancel{I.2} \cancel{3} \cancel{408} \cancel{407} \cancel{406} \cancel{406}}$				11/4	 		409	\(\overline{\pi}\)		0	ô	0	-	85	\sim	162
SCHU. CONTROL DEFLECTION NO. α β	CONFIGURATION SCHO. CONTROL DEFLECTION NO. MACH NUMBERS CONFIGURATION 0 SA JE JE JE RUNS 04 0.6 0.9 0.45 1.05 1.1 1.5 2.2 2.25				406		407	408	W		0	1	-	-		7.2	161
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67 ((1) IDPVAR(;	-	•										. :		1	2
67	IDPVAR													COEFFICIENTS:	EFFIC
67				, ,	-	<u> </u>	<u></u>	<u>-</u> -	<u> </u>	 - -		-			} } }
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		7	337	338	3		2		0	0	0	OD			IA!
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	e4)	4					2		10	0	0	AO	<		198
		W					\		0	0	120	<i>₽</i>			197
		7					/		0	0	0	OA			196
	-	,		-					0	0	0	0	7384	(ø/)	195
	320)		0	0	0	A6	8 (B3L) B3R	(ϕ_I) 73	194
	319						`		0	0	0	A 6	*		143
		₹ .	35P	59	ω,		12		0	0	0	0			192
1284	285	<i>o</i> ₽'.	358	35%	نې		1;		0	0	0	40	83L(B3R)	(ϕ_i) 73	191
	3/8	3,7					2		0	0	0	A6			190
		7	35	ν <u>'</u>	356 355	1 .	W		0	0	0	0 0		,	184
2,50	7286	728	357	V.	356 3:		6		0	0	0	40	73 B3	(b/) 7	188
302	303						12	:	0	0	0	A	3 (B24) B2R	(p1)73	187
30/	300						10		0	0	0	46			186
		<u>'3</u>	353	354	33		2		0	0	0	0	-	-	185
297	299	(i)	353	354	بن		7		0	0	0	4	3 BZL (BZR)	(\$1)73	184
		<i>[1]</i>	352	2)	350 351		W		0	0	0	0 D		f	183
297	296	13	352	57	350 351		5		0	0	0	70	73 B2	(Ø1)7	180
	326						_		o		0	76	(BIL) BIR	(ϕ_I) 73	18/0
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		ERS	MACH NUMBERS				- NO.	CTION	DEFLECTION	CONTROL	_	SCHD.		CONETC	DATA SET

IDPVAR(1) IDPVAR(2) NDV	DPVAR(1)	V													.	NTS:	COEFFICIENTS
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569	2	1557	555	493	 	7	495 494	40	6	-	0	0	20	0	4		103
-		<u> </u>	556		-		496	140	2	l kı	0	0	0	Ø	0		102
		 '' ' 	556		-		36	496	12		С	0	0	0	4	Ø1)T186	101
565		1564	559						W.		0	0	0	0	4	Ø1 V1) TZ B5	180
567		562	5557			-	-		الما 		C	0	20	U	0		189
567		7562	557			-			W	(.)	0	0	20	0	7	(Ø1V1).TI	187
566		563	858				<u> </u>	-	W		0	0	0	D	0	Ø111) 7185	186
315		3/6							10		0	0	0	0	4	<u> </u>	185
				5344	46 345	W	348 347	349 30	6 3	6	0	0	c	Q	0		184
284		290		5 344	46 345	w	348 347	349 34	المين	6	0	0	c	0	4	(\$1)73	183
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				343		10	342	-	10		0	0	0	0	0		140
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				340		<u>v</u>	341 339	نبن	W		0	6	0	7	0		jA6
293	X1	26,	292	340		3,	34/ 336	W	0	_	Ġ	0	Ċ	0	<u>}</u>	(01 VI) 73 B5	145
		7	6						1/1		0	0	0	0	7	(\$1)73 BY FY	144
305		304			-		_		10	 	0	0	0	8	4	(41)T3(B4L)B4R	IA3
308		307						-	N		0			0	Ž	(ϕ_I) T3 B4L (B4R)	RD71A2
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☐ PRETEST

														SCHEDULES
⇒ IDPVAR(1) IDPVAR(2) NDV	AR(1) IDP	IDPV	-							300	A	108	S: E=	COEFFICIENTS
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75 76	67	61	55	64	43		37	31		2.5		19	13	ì
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	540	545	486 552		485	484	6		0	 	0	7) TH B7A1-5	1E4 (p)
	53/						_		0	0	0	17.		183
	534						_		0	0	0	EO		1E2
	536	(25E)	462 548		104 00	490	0		0	0	0	00		IEI .
	536	\$ 547	492 548	,	10 491	490	0		0	0	0	40	(\$1) TH	
			487		£84 6.	489	W		0	0	70	0	-	128
			487		884 5	489	ننا		0	0	0	AO	1) 74 87-4	1D7 (d1
	525	5 522	514 515		2513	5/2	0	-	10	0	0	AG		126
	537	1544	481 55		3 482	483	0	anz	10	0	0	0		1.05
	537	11544	481 551		3 482	483	9		10	0	0	AO		1,04
	526	6521	509 516		1 508	5//	0		Ö	0	20	AG		<i>[P3]</i>
	537	0543	480 550 543		KHB	478	9		0	0) 20	0		1,02
	538	0543	480 550		8 479	478	0	:	0	0	20	40		/D/
	527	7 520	504 517		6 507	506	6		0	0	0	AC		169
	539		475 549			477	0		0	0	0	0		108
	539	14 543	475 549		76.4	6.64	0		O	0	0	0 4	1) 74 8741-4	167 (4
	566	3 563	550				w		0	0	0	40	Ø141)7185	<u> </u>
												_		105
	569	5554	493 555		7 494	495	0		0.			0	1)7186	RD71C4 (4
	2,28 4,5	2.2	05 11 1.5	0.95 1.05	60.90	0.4 0.0	S		Sign			αβ	CONFIGURATION	FIER
	***************************************	***	MACH NUMBERS	MACI			NO.	DEFLECTION	DEFL	CONTROL		SCHD.		DATA SET
POSTTEST	30d F		•							1			J.	

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TABLE 2.

DATA SET COLLATION SHEET (CONTINUED)

DENTIFIES CONFIGURATION SCHOOL DEPLETICAL NO. MACH NUMEERS																
CONFIGURATION Control definition Control of Contro				٠		}									S:	SCHEDULE
CONFIGURATION CONTROL DEFLECTION TO TO TO TO TO TO TO	2) NDV	(1) IDPVAR(IDPVAR												ENTS:	COEFFICI
CONFIGURATION CONTROL DEFLECTION NO. (b) 74 87A1 -5 A 6 0 0 0 6 4 4 4 4 5 4 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8			1	} + + +		-	-			}	}	_		+		-
CONFECURATION Sciii. CONTROL DEFLECTION OF OF OF OF OF OF OF	75 76	67	61		55	6.4	43	7	3	31		25		19		1
CONFIGURATION SCIID CONTROL DEFLECTION OF OH OH OH OH OH OH OH											-		250000			
CONFIGURATION CONTROL DEFLECTION OF								-			-	_				
TA SET CONFIGURATION SCIID. CONTROL DEFLECTION NO. MACH NUMBERS MACH NUMBERS MACH NUMBERS										 	_	_				
CONFIGURATION SCIID. (a) 5 A 4E 4R (b) 174 B7A1 - 5 A 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													41505.2			
CONFIGURATION CONTROL DEFLECTION NO. CONT										-	_					
CONFIGURATION SCHD. CONTROL DEFLECTION OF JOHN NUMBERS MACH NUMBERS CONTROL DEFLECTION OF JOHN NUMBERS MACH NUMBERS MACH NUMBERS MACH NUMBERS ACH NUMBERS															•	
CONFIGURATION CONTROL DEFLECTION NO. MACII NUMBERS																
CONFIGURATION SCHD. CONTROL DEFLECTION NO. MO. MACH NUMBERS (b) TH B7A1-5 A C O O O O O O O O O O O O O O O O O O											-					
CONFIGURATION SCHD. CONTROL DEFLECTION NO. MO. MACH NUMBERS (\$\phi\$)74 8741-5 A & 6 & 6 & 72 & 72 & 72 & 72 & 72 & 72 &												_				
CONFIGURATION CONTROL DEFLECTION NO. MACH NUMBERS											-					
CONFIGURATION SCIID. CONTROL DEFLECTION OF ONLY NO. MACH NUMBERS (b) TH 87A1 - 5 A C O O O O O O O O O O O O O O O O O O																
CONFIGURATION CONTROL DEFLECTION NO.													. Zito pa			
CONFIGURATION SCHID. CONTROL DEFLECTION OF																
CONFIGURATION SCHD. CONTROL DEFLECTION OF OFF OFF OFF OFF OFF OFF OFF OFF OF																
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$																
CONFIGURATION CONTROL DEFLECTION NO. NO. NACH NUMBERS		568	61	560 50					W				D	0	1	171
CONFIGURATION SCHD. CONTROL DEFLECTION NO. α NO. α MACH NUMBERS ϕ // TH B7A1 -5 A </td <td></td> <td>568</td> <td>19</td> <td>560 5</td> <td></td> <td></td> <td></td> <td></td> <td>ω</td> <td></td> <td></td> <td>0</td> <td>0</td> <td>14</td> <td>)72A</td> <td>159</td>		568	19	560 5					ω			0	0	14)72A	159
CONFIGURATION SCHD CONTROL DEFLECTION NO MACH NUMBERS		535	64					1	8				D	0)72 B	831
CONFIGURATION SCHD. CONTROL DEFLECTION NO. α B $\forall A$ $\not f \in f \in f$ RUNS α B $\forall A$ $\not f \in f \in f$ RUNS α B α		528							_				0	4	4	
CONFIGURATION SCHD. CONTROL DEFLECTION NO. MACH NUMBERS $\alpha \beta $		530	19	512 5	797	·		40	e			-	0	A	8741	7
SCHO. CONTROL DEFLECTION NO.					1.1	0.95	L		1	2	1	4		Ω	CONFIGURALION	IDENTIFIER
		A		S	H NUMBER	NVW			n O	ECTION	L DEFI	ONTRO	1	SC	COMPTONIATION	DATA SET

TEST 5-222

TANK & BOOSTERS @ TANK MRC

TABLE 2. __ DATA SET COLLATION SHEET (CONTINUED) PRETEST

a or b	CN.	-	220	219	218	217	216	2/5	214	213	212	2//	210	204	308	207	306	205	204	203	202	RP7201	IDENTIFIER	DATA SET	
	CY.	7																		RD7 1××	DATA SE	NOTE: SAME AS	COM LOCK	CONFICURATION	
	EA.	1.3																		^	75	AS	100	TON	
	CAF	19																					αβ	SCHD. C	
	CB2	2.5																					RUNS	ONTROL DE	
	W75	31																						FLECTION	
	EYN	37																					RUNS	Z.S	
	[` - -	43																							
	} } }	64																						МУС	
-	-	55																						MACH NUMBERS	
	1 3	61																							
DP VAR (1)	MACH											-													
IDE VAR(I) IDE VAR(E) ADV	BETA	67	-												 										
71204	Vignal A	75 76																							

5-222

DATA SET IDENTIFIER RD7301 3/6 315 314 3/3 3/2 311 308 307 310 309 306 305 304 303 302 ORBITER @ TANK MRC NOTE: SAME AS CONFIGURATION RDDIXX DATA SETS TABLE 2. TEST SCHD. CONTROL DEFLECTION NO.
of
RUNS DATA SET COLLATION SHEET (CONTINUED) MACH NUMBERS POSTTEST PRETEST 24

α or β SCHEDULES

COEFFICIENTS:

755

5

EAF

1C.B1

319 318 3/7

320

TABLE 2. TEST S-222

DATA SET COLLATION SHEET (CONTINUED)

- COEFFICIENTS: a or § SCHEDULES	CN	1	420	419	418	(14)	416	4/5	414	4/3	4/2	11/4	410	409	408	467	406	405	404	403	402	RD7401	IDENTIFIER	DATA SET	- - ·
NTS:	157	7 1							•											RDTIXX	DATA SETS	NOTE: SAME	CONFIGURALION		COMPOSITE @
	CA.	1.3																			75	E 45	CN		
	CAF	19						J															1 1	SCHD.	142 K
	CBL	2.5																						CONTROL DE	TANK MRC
	ELM	31																					RUNS	FLECTION	
	EYN	37												A.P.									RUNS	, o	·
		3 ډا																							
	 - - -	64																						MVCI	
	<u> </u>	55																						MACH NUMBERS	
V H	7.7	61																							
IDPVAR(1) IDPVAR(2) NDV	MACH							·																	d C
IDPVAR(2)	BETA				-												-								PRETEST POSTTEST
NDV		75 76	Ŀ								25												<u></u>		ST

TABLE

'n

TEST

5-222 DATA SET COLLATION SHEET (CONTINUED)

IDPVAR(1) IDPVAR(2) NDV	•									'S:	COEFFICIENTS:
		- -	-	EYM	CLM	[C81	-	CAF	CY CA	CM
	55	64	43	37	31		2.5		19	7 13	-
51 56	73		72	16	6	O	O.	0	AO	Ø1 73 BY	520 0
48 39				~	ω ω	Ċ	C)	0	A 6	*	519
49						0	0	0	40	017382	518
28 29	90		92 91		6	0	0	0	40	4	512
14 13	8)		83 82		2	0	0	O	AO	Ø, 71 B2S	516 9
24 27	53		87 88	***	6	C	0	0	4	*	5/5
15 12	86		84 85	30		0	0	0	40	61.7182	514
						10	0	0	00	*	5/3
			-			0	٥	20	OD		5/2
						0	a	0	00		5//
187					2	10	0	0	40		510
186 423					2	6	0	20	AO		509
196						0	0	0	A6		305
185					2	0	0	0	40	\$17181+Pune(2.5)	507 6
	80				/	0	0	C	NO	V	306
						0	0	Ö	00		505
16 11			77 78	7	2	0	0	Ö	80		405
197				/		0	0	0	A 6		503
25 26	93		95 94	6 9		0	0	0	400		502
16 11	79	V	86. 66	7 7		Ċ	0	0	40	Ø17181	RP7501
s 1.5 2.2	MACH NUMBERS	0.93	60.9	NS 0.4 C	DEFLECTION NO.	DEFLEC SR	CONTROL	i _ J	SClib.	CONFIGURATION	DATA SET IDENTIFIER
							7	X 3	I ANK ISK	COMPOSITE (e)	
	•)		ł		-

TABLE 2.

5-222

_ DATA SET COLLATION SHEET (CONTINUED)

PVAR(2	IDPVAR(1) IDPVAR(2) NDV	DPVAR															[ENTS:	COEFFICIENTS:
	-	-	-	† †		-	+	-	-	}	-	-	E	}	F		<u> </u>	
75 76	67		61	5	55	6.4		£ 1,	37		31		2.5		19	13	7]-
			430	433						N	0	0	20	0	F			540
		-	, 437	434						2	C	0	0	D	0			539
		Ť	437	434						2	0	0	0	Ġ	7	PITIBI+PLUME (15	Ø17181	538
		Ť	430	429						~	10	0	0	Ð	0			537
		-	430	429	-					13	10	0	0	0	4			536
	·			428						\	0	0	0/-	A	0			535
			4	428						\	0	0	-/0	0	Z			534
				427						1	0	0	10	ם	0			533
				427	-					-	0	0	10	0	Z			532
		,	432	426						2	0	0	20	A	0			53/
			432	426						12	0	0	20	0	7			530
			425 431	425						2	0	0	0	D	Ò			529
			431	425	-		-			N	0	0	0	0	7	181	\$171	528
-	37		├ ──	47	36		97	98		0	0	0	0	61	4	•		527
	52		57	50	74		75	76		6	0	0	0	0	4	3 84 F4	\$173	526
	62		55	577	63		64			•	10	0	0	0	\$			5:25
	(7)		57	573	68		67	69		6	0	0	20	0	Z			524
-	36		27	45	102		103	104/		6		0	0	Ŕ	0			523
	35		42	4.5	101		100	99		0	Ľ	0	0	0	Ž			522
	60		5%	5/	73			7/		6	0		0	¥	0	73 BY	7 16	PD7521
	4.5	2,25	2.2	1.5	5 1.1	.95 1.05	0.9 0.	0.6 0	0.4	RUNS	R	SE SR	JA C	$_{\rm L}$	ρ	CONFIGURATION	CONFIC	IDENTIFIER
				6					Ī	1	CONTINUE PERSONAL STATES	70 001	CCLLETIC		10000		201111	· · · · · · · · · · · · · · · · · · ·

TABLE 2. TEST S-222

DATA SET COLLATION SHEET (CONTINUED)

IDPVAR(1) IDPVAR(2) NDV	VIDPVAR(CLENTS	COEFFICIENTS:
			F		-		}	-	İ	-	[-			+ + + + + + + + + + + + + + + + + + + +		
67	61		55		64	43		37		31		2.5		19	1.3	7]-
		453	7			_			-	10	0	0	0	ケ	~		560
		454	7				-		-	0	0	20	A	0			559
		454	_	_			-		_	0	0	20	0	4	-		558
		554	7	 					_	0	0	0	A	0		7	557
		1554	7						_	0	0	0	0	E (1.5) A	\$17386+Privine (1.5)		556
	744	1								10	0	0	Ä	0	<u></u>		555
	446	٧.								10	C	0	0				554
	449	4 544	4				ļ		2	10	0	0	OB			-	553
	but	bht 5hh	4	 					2	10	0	0	40			10	552
	747	444	7	_		<u> </u>	-		7	0	0	20	Q	0			531
	147	444 HHJ	7	 			-		2	0	0	20	0	A			550
	448	443.4	4						2	0	0	0	ð	0		2)	549
	448	443 4	1						2	0	0	0	0	4	17386	0/	348
	440	441 4	1				-		12	!	1	j	7	0	<	7	547
	440	1411 4	1						17	1]	1	40		T385		546
	437	442 4	4						ľV	1	1	j	00	2	~ -	-	545
	439	442 4	2						N		j	1	0		7382		445
	436	435 4	4						2	10	Ö	o.	D.	0	~	3	543
	436	435 4	1				-	-	N	10	0	0	0	A	 	10	542
	438	433 4	4						2	0		20	D	(1.5) 0	917181+ PLUME (1.5		RD7541
4.5	2.2 2.25	1.5 2	1.1/	1.05 /	0.25	609	4 0.6	0	RUNS	SR	38	δA			CONFIGURATION		IDENTIFIER
								Ī	-		1		00:00		ONIT CHE ATTOM		

_ DATA SET COLLATION SHEET (CONTINUED)

DATA SET		SCHD.		CONTROL	0L D	DEFLECTION		NO.					МЛСН	MACH NUMBERS	ERS						
IDENTIFIER	CONFIGURATION	ρ		84	38	Se		or RUNS	0.4	0.6	0.90	Ö	25 1.05	5/1/	11.5		2,22	25.25	7.5		
RD7561	\$173 BL+PLUME (1.5)	0	Ø			0%		/							45	453					
562	\$173BL+PLUME (2.2)	4	0	٥	0	0		/									450				
563		0	D	0	c	0		/								4	450				
564		4	0	20	0	0		/						·		4	457				1
565		0	Ċ	20	C	0		/							ļ I	4	451				l
566		4	0	0	0	10		/								4	455				1
567	4	0	D	0	0	10		/					<u></u>			4	452				
568	7185	4	0	1	1	1		?							4.	4574	457		_		
569	~	0	\mathcal{D}	1	1	١		Ŋ							4:	457 458	15			-	1
570	7186	4	0	1	1	1		6		47/	470	0		469		456 459	53		509		
571		0	A			1		6		47/	470	0		469		456 459	20		605	_	
572	Ø17487A1-4	4	0	0	0	0		4			460	0	_	461	+	5985	572				
5.73		0	A	0	0	0		4			460	0		461	1	59P 5	572				
-	\$17487A1-4+ Pure/15) A	0	0	0	0		\							5	586					1
575	-	0	\mathcal{D}	0	0	0		\							2	285			-	ļ	
24.5		4	0	20	0	0		/							5	588				-	ì
572		0	0	20	0	0		_			-		-		5,	588			-		1
578		ア	0	٥	0	10		\						-	5,	587	_			-	
579	V	0	D	0	0	10		~							3	5.4.7	_				1
580	580 \$1748741-4+ Pune (2.2)	A	Ċ	0	Ô	0									-	15	577	_	_	_	1
	7 13	19		25	5	/33	31		37		43		64		55		61		67		75 76
		-	ŀ	Ŀ	ŧ		-		-	-			-		-	ł	-	}	-		-
COEFFICIENTS:	LENTS:	-													•		#IDP	VAR (IDPVAR(1) IDPVAR(2) NDV	VAR(2	$\stackrel{\sim}{=}$
a or g													• •			•					

5-222

DATA SET COLLATION SHEET (CONTINUED)

				•													S	SCHEDULES
!) NDV	IDPVAR(1) IDPVAR(2) NDV	PVAR (1)	IDI														ENTS:	
		1	_	<u> </u>	-			-	<u> </u> - -	-	<u>}</u>					- - - -		
75 76	67	9	61		55	49		14.3		37	31	3	2.5		19	13	7]-
		-		582			-	-	-		0	Ö	0	0	40	H+Pwine(1.)	pIVITHBAR: - 4+ PINNE/(. +)A	541
			588	596			-	-	_	2	20	10	0	0	07		\ \ \	599
			589	596			-	_	-	10	20	10	0	0	0			865
		-	590	595					-	10	20	O	0	0	0			597
			590	595 590			-	-	-	10	000	0	0	0	40			596
			591	594			 			2	0	10	0	0	0			595
			591	594 591		-		-	-	10	0	10	0	0	10			594
			592	593			-		-	12	0	0	0	0	00			593
			592	593		-	-	-	-	2	0	0	0	0	40		Ø1V17487A1-4	592
			599		646		4	645 644	6	7	1	1	1		B	0	\	591
			599		646		- Li	645 644	60	7	1	1	1	١	40	7A1-4 /	T4F187.	590
	140	604	573	600	462		<u>ω</u>	474 463	4	0	Ì	Ì	1	1	00		~	589
	7	604	573	600 573	762		ζ. 	474 463	4	0	1	1	ī	i	40	41-1	TH 872	588
			570	597				_	-	2	0	0	0	0	00		*	587
			570	597				-	-	N	0	0	0	C	0	2	Ø174F1 87A1-	285
			27.5					 			0	10	0	0	0		~	585
		_	576						_		0	10	0	0	4 0			584
		-	575			-			-	_	C	0	0	20	0 7			583
		_	575						_	_	0	0	0	20	40		_	582
			577								0	0	0	0	OD	200	\$17487A1-4+Pernet2.2	RD7581
	2	2.25 4.5	2:2:	1.5	1.1	0.95 1.05	I	6 0,9	0.7 0.6	RUNS 2	SRFR	त्रिह	36	54	Ω 52		CONFIGURALION	IDENTIFIER
				S	MACH NUMBERS	MACH 1				, o	TION	CONTROL DEFLECTION	ROL I	CONT	SCHD.		CONFICURA	DATA SET
EST	POSTTEST	早																-
S	PRETEST																	-
																		•

											i	a or p
IDPVAR(1) IDPVAR(2) NDV	•										ENTS:	COEFFICIENTS
		-	-	- - -	}		-	_				-
61	55	64	ı ₁ 3	37		31	25	2	19	13 1	7]-
					_				-			
						L						
					_	_						
574					20/	10	0	0	00			583
579					20/	10	0	0	0			587
2.28					20 /	0	0	0	OD			586
578					7 02	0	0	0	A 0			585
520					0 /	10	0	0	OD			5B4
520					0 /	10	0	0	A O			583
125					0	0	0	0	0 D			582
581					0	0	0	0	AO	PIVITYBTALY+PLIME(2.2)	PIVITHB7,	581
4	1885				20 /	10	0	0	00		~	5A8
4	782 182				20 /	0	0	0	40			5A7
71	585				20 /	0	0	0	Q. D			5A6
<u> </u>	585				20 /	0	0	0	A C			5,45
ω	583				0	10	0	0	07			5A4
03	583				0	10	0	0	0			543
10				/	0	(' '	0	0	D	RD7542 \$1V1T4B7A1-4+Pune(1.5) 0	Ø111748.	RD75A2
2.2 2.25	MACH NUMBERS /. 05 /. 1 /.5	0.95	0.6 0.9	0,4	CTION NO.	CONTROL DEFLECTION SA SE SP SRE	ROL DI	CONT	SCHID.		CONFIGURATION	DATA SET IDENTIFIER
												٠

TABLE 2. TEST

S-222 DATA SET COLLATION SHEET (CONTINUED)

TABLE 2. TEST S-222 DAT

BOOSTER @ BOOSTER MRC PITCH FLANE

FIGURATION SCIII. CONTROL DEFLECTION NO. coefficients:	C.W	1 7			•			218	1/3	810	809	808	807	806	805	804	803	802	RD7801	R	DATA SET	
SCIID. CONTROL DEFLECTION NO. a 8 5p	7								8127	B1 D6	8102	B172	8122	8/52	8151	BY	<i>B3</i>	825	82	81	ONFIGURALION	ONETCHBATTON
CONTROL DEPLECTION of St. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	30	E.4	19							-	-	├	├		} —	 	+	 	1	_	Ω	SCHD
MACH NUMBERS 0.4 0.6 0.7 0.9 0.95 1.1 1.5 2. 170 1.20 1.21 1.7 182 1.20 1.21 1.7 183 1.22 1.7 183 1.22 1.7 184 1.8 1.9 1.8 1.7 185 1.9 1.9 1.8 1.7 185 1.9 1.9 1.9 185 1.9 1.9 1.9 185 1.9 1.9 1.9 186 1.9 1.9 1.9 187 1.9 1.9 1.9 187 1.9 1.9 1.9 187 1.9 1.9 1.9 187 1.9 1.9 1.9 187 1.9 1.9 1.9 187 1.9 1.9 1.9 187 1.9 187	A	-			<u> </u>					-	_	-	-	0	i	0	i	0	0	1		
MACH NUMBERS O.4 0.6 0.7 0.9 0.95 1.1 1.5 2. 17	610	C82	2.5																			ROL DE
MACH NUMBERS O.4 0.6 0.7 0.9 0.95 1.1 1.5 2. 17		75	31								_	_			-		-	-				FLECTI
MACH NUMBERS 0.4 0.6 0.7 0.9 0.95 1.1 1.5 2. 170 1.20 1.21 1.7 180 1.20 1.21 1.7 180 1.20 1.21 1.7 180 1.20 1.21 1.7 180 1.20 1.21 1.7 180 1.20 1.21 1.7 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 180 1.20 1.20 1.2 190 1.20 1.20 1.20 1.2 190 1.20 1.20 1.20 1.2 190 1.20 1.20 1.20 1.2 190 1.20 1.20 1.20 1.2 190 1.20 1.20 1.20 1.20 1.2 190 1.20 1.20 1.20 1.20 1.2 190 1.20 1.20 1.20 1.20 1.20 1.20 1.20 1.2		M							ë	6	ω	2	0	0	0	17	2	4	2	4	RUNS	ON NO.
MACH NUMBERS 0.7 0.9 0.95 1.1 1.5 2. 117 116 121 17 120 121 17 123 122 17 133 122 17 637 638 638 639 612 642 627 628 609 633 632 631 610 634 635 636 611 634 635 636 611		NX3	37																		1	Ī
MACH NUMBERS 0.7 0.9 0.95 1.1 1.5 2. 117 116 121 17 120 121 17 123 122 17 123 122 17 123 122 17 123 637 638 639 612 641 641 640 613 624 627 628 609 633 632 631 610 634 635 636 611 49 55		+	43																		 	
MACH NUMBERS 0.95 1.1 1.5 2. 0.95 1.1 1.5 2. 112 12 17 122 17 123 639 612 641 640 613 627 628 609 632 631 610 635 636 611 635 636 611		-							634	633			626	642	637			·			7	
6/10 609 613 17 17 17 17 17 17 17 17 17 17 17 17 17	1	-	64	 					6	6	67		61	6,	63	1/3	14	23	20	17	!!	MAC
6/10 09 6/12 17 17 17 17 17 17 17 17 17 17 17 17 17		}								32 63						//	. //d	/22	/2/	1116		1 NUMBI
		F	55				İ		+	+	3				1612	/6	-				1.5	RS
2.5 4.5 169 169 622 606 623 607 629 608 621 617 619 616 619 616 67 ACH MLF	Į.	13	61													188	17/	173	172	170	2:2	
608 608 608 608 608 608 608 608 608 608	FVAK(J	4CH								ł	62/	624	620	623	622						2.5	
	ראל דחג מ	ALPHA	67				 <u> </u>		616	617		525	608	607	900	195	168	167	166	169	4,5	
	NUV	7	75 76								·			<u> </u>								

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TABLE 2. TEST

5-222

DATA SET COLLATION SHEET (CONTINUED)

													LES	SCHEDULES
IDPVAR(1) IDPVAR(2) NDV	-												COEFFICIENTS:	COEFFI
	-	-	-		<u> -</u>		-		-	·	-			
61 67 75.76	55	64	43	_	37		31		2.5		19	1.3	7	-
						-						•		
		195	188	112	1/3	4			I	0	Ā	84		885
		168	1771	//8	119	¥			}	0	4	<i>B</i> 3		488
		167	173	122	/23	4	_	-	1	0	4	8:25		883
		166	172	12/	120	4		_	ı	0	4	82		882
		169	170	116	1//7	4		_	١	0	4	BI		881
									133					
		195	cfef/	//2	//3	4			I	0	A	84	01	8A5
		168			1/9	4			1	0 +	.4	<i>B</i> 3		8A4
		167	173	/22	123	4			1	0	A	B2S	3	8A3
		166	 		120	4	-		ı	0	4	<i>B</i> 2	13	842
		169	170	116	//7	4			1	0	ア	8/		RD7841
		4.5	2.2	1.1	0.9	RUN	SD RUNS		as	72	ρ	CONFIGURATION		IDENTIFIER
	MACH NUMBERS	MACH			П	ON NO.	FLECTI	OL DE	CONTR	SCHD.	Sc		1	DATA SET
☐ PRETEST ☐ FOSTTEST		אנו יָּעוּ	PLANE PLANE	PITCH		MRC	73	TAXX TAXX		9 4	BOOSTER (Q)	RD78AX L	מ מ	• •

{IDPVAR(1) IDPVAK(2) wbv	R(1) 1DF	TDPVA	•											ES -	COEFFICIENTS; a or § SCHEDULES
7A 7	BETA	MACH	1		-	-	EYN/	M	K75	CBL	}	EAF	ICA.	15Y	CX
75 76	67	61	55	64		1+3	37		31	2.5		19	13	7	~
									-						
				195	1 500	112	1/3	7.			1	0	184		985
				168	171	113	119	<i>عد</i>			4	0	83		984
	-			167	173 /	122	/23	4			A	0/	B2S		983
			 	166	172 /	121	120	4.	_		A 1	0	82		982
				169	170/	116	117	7	-		A	0	B /.	7	981
									-						
				95	1881	1/2	//3	1/	-		7	0	BY	1	9A5
				168	17/	118	1/19	4		ļ	7	0	8.3	000	944
			-	167	173 /	122	123	4			7	0/	B2S	7	9,43
				166	172 /	/2/	/20	4			1	0 4	8.2	1	9A2
				169	170 /	116	//7	4			+	OA	B1	į	941
									-						
				5.8	1881		//3	4			-	0 4	BY	Ŕ	905
				163	/7//	118	119	1.			- (OA	B:3	В	904
				62	173 /	122	123	ć			1	04	BZS	B	903
				66	172 /	12//	120	7			1	0 4	2	82	902
				169	170 1	116	117	Ţ			+	0 4)	<i>B</i> /	RP7901
				4,5	2.2 4	1	0.9	RUNS				Ω	CONFIGURATION	CONFI	IDENTIFIER
	-	***************************************	UMBERS	MACH NUMBERS				· ON NO	DEFLECTION	CONTROL DE		SCHD.	Olip tell to	201111	DATA SET
POSTTEST	13 FO		:		CHNE	Ċ	¥4¥	MRC		TANK T3		734		RD	-
- PRETEST	☐ PR				PLANE	· .	× 4 × 4 × 4 × 4 × 4 × 4 × 4 × 4 × 4 × 4	ひなび		TANK TI	(g) (g)	752	RPT9XX BOOSTER	a & &	. •
		ONCLUDED)	SHEET (CONCLUDED)	TION SI			Þ	DATA		S-222	1	TEST	N		0
			1 1											Ď	*830-528

TABLE 3. MODEL COMPONENT DESCRIPTIONS

MODEL COMPONENT: BODY	1 - B1 , B2		
GENERAL DESCRIPTION:	040A Orbiter Body		
	B. INCLUDES CANO	PY	
·	B2 WITHOUT CAN	Yac	•
		·	
DRAWING NUMBER:	JLP SDD 9-24-71	•	•
P'MENSIONS:	, , , , , , , , , , , , , , , , , , ,	FULL-SCALE	MODEL SCALE
Length, inch	• •	1315.	7.89
Max. Width, inch	•	204.	1.224
Max. Depth , inc	h	238.	1.427
Fineness Ratio		7.07	7.07
Areas, inch			. •
Max. Cross-	Sectional	306.2 ft ²	1.590 in. ²
Planform		1676. ft ²	8.68 in. ²
Wetted		6530. ft ²	33.8 in. ²
Base		298. ft ²	1.546 in. ²

SENERAL DE	SCRIPTION: 040A	Orbiter clipped	delta wing	
•			11,	
• • • • • • • • • • • • • • • • • • • •				• .
				•
DRAWING NU	MBEX:	JLP SDD 9-24-7	1	•
DIMENSIONS	:		FULL-SCALE	MODEL SCALE
TOTAL	DATA, INCLUDES	ELEVONS		
	Area .			
	Planform	•	3155.3 ft ²	16.37 in. ²
	Wetted		5360. ft ²	27.8 in. ²
	Span (equivalent)	, inch	882.	5.292
	Aspect Ratio	,	1.712	1.712
	Rate of Taper	•		
	Taper Ratio		.1486	. 1486
•	Diehedral Angle,	degrees	7.0	7.0
	Incidence Angle,		1.5	1.5
	Aerodynamic Twist	, degrees	0	0
	Toe-In Angle		-	
	Cant Angle			
	Sweep Back Angles	, degrees		
	Leading Edge		60.	60.
•	Trailing Edge		0	0
•	0.25 Element L	.tne	52.4	52.4
	Chords: inch	. 0.0\		
	Root (Wing Sta		_897	5.38
	Tip, (equivale	(Y = 441)	133.3	800
	MAC Stands	05 416	609.5	3.657
	Fus. Sta. of .		X 1057.5	6.36
	W.P. of .25 NA		Z 302.3	1.812
•	B.L. of .25 NA	IC .	Y <u>165.7</u>	.996
	Airfoil Section	·	NACA 0008-64	NACA 0000 6
	Root			NACA 0008-6
EVOC	Tip		NACA 0008-64	NACA 0008-6
EXPUS	ED DATA, INCLUDE:	S ELEVONS	•••	:.
	Auga		2010. ft ²	14.45 in. ²
	Area Soon /oouivalont	.1		
	Span, (equivalent	.), inca	678.	4.07
	Aspect Ratio		1.590	1.590
	Taper Ratio		1850	.1850
•	Chords, inch Root (Y102)	•• • •	720	
			720.	4.32
	Tip (Y441)	•	133.3	.800
	MAC Stanof	25 MAC	494.	2.97
•	Fus. Sta. of . W.P. of .25 M	ico l'int	X 1145.5	6.87
			Z 308.1	1.87

MODEL COMPONENT: ELEVONS		
GENERAL DESCRIPTION:		· .
DRAWING NUMBER: JLP SDD 9-24-71		
DIMENSIONS: (FOR BOTH ELEVONS)	FULL-SCALE	MODEL SCALE
Area	456. ft ²	2.36 in. ²
Span (equivalent), INCH	556.	3.33
Inb'd equivalent chord, INCH	118.	. 708
Outb'd equivalent chord, INCH	118.	.708
Ratio movable surface chord/ total surface chord	•	•
At Inb'd equiv. chord	.1662	.1662
At Outb'd equiv. chord	.517	.517
Sweep Back Angles, degrees		
Leading Edge	0	<u> </u>
Tailing Edge	0	0
Hingeline	0	0
Area Moment (Normal to hinge line)	2240. ft ³	.835 in.

	CENEDA S	CCCNTNTTAN -	OKON O-FE		D-1 -	Dash' 1 Ja	and tradition size
	GENERAL DI	ESCRIPTION:	U4UA OFBI	cer vertical	rin.	Both leading	and trailing edge
1	swept.		·				
		٠.		•		$\sim \sim N_{\odot}$	
				•			
	DONUTNO	/ 103050 •	ם דו	SDD 9-24-71		-	
:	DRAWING N		J1.r	300 9-24-71			
	DIMENSION	<u>s</u> :	•		•	FULL-SCALE	MODEL SCALE
	TOTA	L DATA, INCL	UDES RUDDES	, excludes t	IP POD		
		Area	•			9	
		Planform	1		•	342. ft 2	1.772 in.^2
	•	Hetted		· · ·	:	684. ft ²	$\frac{3.55 \text{ in.}^2}{3.600}$
	•	Span (equiv Aspect Rati				1.228	1.480
	٠	Rate of Tap				1.220	1.220
	•	Taper Ratio		• :		.374	.374
	•	Diehedral A		ees	•		**
		Incidence A	Ingle, degra	28\$		O	0
		Aerodynamic		rees		0	0
		Toe-In Angl	e				
		Cant Angle	1 1				**
		Sweep Back Leading		grees		45.	
		Trailing				15.	45. 15.
		0.25 Ele	ment Line			40.75	40.75
		Chords: INC		•		- 40.75	-40.73
			MARIO SOLO COCA	XX(Z 500)		291.6	1.750
	•	Tip, (ed	uivalent) (746.2)		109.0	.654
•		MAC	•			214.0	1.284
			i. of .25 M	AC .	X	1422.7	
		W.P. of			· Z	604.2	
			.25 MAC			0	
		Airfoil Sec Root	tion		NTA (CA 0012-64	NACA 0012-64
•		Tip			4	1 11 11 11 11 11 11 11 11 11 11 11 11 1	11 11 11
	EXPO	SED DATA			•		
							
•		Area			•		
^	· ~ .	'Span, (equi		. ,			
٠.:		Aspect Rati	io				
		Taper Ratio	•	1			
		Chords	. •	1			•
•		Root	•	SAME			-
•		Tip MAC	•	ABOVI			· ———•
			a. of .25 M		• .		
		W.P. of	.25 MAC		•		
			.25 MAC	}	•		• •

MODEL COMPONENT: RUDDER- R1		
GENERAL DESCRIPTION:		
		· ·
DRAWING NUMBER: JLP SDD 9-24-71		
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Area	135.6 ft ²	.702 in. ²
Span (equivalent), INCH	246,3	1.475
Inb'd equivalent chord, INCH	115.	.690
Outb'd equivalent chord, INCH	43.8	.263
Ratio movable surface chord/ total surface chord		-
At Inb'd equiv. chord	.40 •	40
At Outb'd equiv. chord	.40	.40
Sweep Back Angles, degrees		
Leading Edge	29.1	29.1
Tailing Edge	15.0	15.0
Hingeline	29.1	29.1
Area Moment (Normal to hinge line)	448. ft ³	.145 in.

ENERAL DESCRIPTION: C	enterkine Stabi	13705			
			-		<u> </u>
			·	· .	
	•				
					•
•	4770				
RAWING NUMBER:	NR .			•	
IMENSIONS:			•	FULL-SCALE	MODEL SCAL
TOTAL DATA		•			
Area .		٠.			
Planform					
Wetted		•			
Span (equiva	lent)				
Aspect Ratio					
Rate of Taper	r ,	. •			
Taper Ratio	alo dobuone	•			····
Diehedral And Incidence And	gie, degrees	•			. ————
Aerodynamic	Twist, degrees				***************************************
Toe-In Angle	inist, acgrees				
Cant Angle		•			
	ngles, degrees	•			0
Leading Ed	dge	•		45°	45°
Trailing P	Edge		•		
0.25 Eleme	ent Line		•	` 	•
Chords:	- 642 0 0)	•	• •		
	g Sta. 0.0)				
Tip, (equi MAC :	ivatenc)			*****	
	of .25 MAC		-		
W.P. of .					
B.L. of .:					
Airfoil Sect					-,,
Root				NACA 0012-64	
Tip				NACA 0012-64	
EXPOSED DATA					
Area				69,837.3 ²	2.514 i
Span, (equiv	alent)			369.17 in	2,215 1
Aspect Ratio				1.95	1.95
Taper Ratio	•	. •		0,3137	•3137
Chords					
Root				288.0 in	1.728 1
Tip	•			90,35 in	0.542 1
MAC				206.38 in	1.238 ii
	of .25 MAC	•		1469.04	8.814
W.P. of B.L. of .				652.44	3.915 0

MODEL COMPONENT: RUDDER R2		për kushinginin Millian dhekisin qëplimin nëpërmanjar marinar ma
GENERAL DESCRITION:		
	agangki daga dak agan dan karangkaran samuran sahiri masanggang karandasis	
NATURE OF THE PROPERTY OF THE		
DRAWING NUMBER:		
DINENCTONC.	EIN I SCALE	MAREL COALE
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Area	181 ft ²	.939 in ²
Span (equivalent)	346 in	2.073 in
Inb'd equivalent chord	115 in	.691 in
Outb'd equivalent chord	36 in	.217 in
Ratio Elevator chord/horizontal tail chord		
At Inb'd equiv. chord	.40	.40
At Outb'd equiv. chord	40	.40
Sweep Back Angles, degrees	•	
Leading Edge	32°	32°
Tailing Edge	21°	21°
Hingeline	32°	32°
Area Moment (Normal to hinge line)	569 ft ³	.212 in ³

MODEL COMPONENT: BODY - ACPS ENGINE I	POD P1	
GENERAL DESCRIPTION: Blunt pod mounted	on both wing tips.	
	•	
DRAWING NUMBER: JLP SDD 9-24	-71	•
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length , inch	165.	.990
Max. Width, inch	55.	.330
Max. Depth , inch	28.	.168
Fineness Ratio		
Areas, in. ²	a. acc	
Max. Cross-Sectional	1540.	.0555
Planform	8280.	. 298
Wetted	15,800.	.568
Base	1540.	.0555

MODEL COMPONENT: BODY	_ OMS	ENGINE	POD , 1	a		
GENERAL DESCRIPTION: _	Pods	mounted	on both	sides of aft	end of	fuselage.
	,					
						•
·						
DRAWING NUMBER:		JLP SDD	9-24-71			•
DIMENSIONS:		· · · · · · · · · · · · · · · · · · ·	•	FULL-SCALE		MODEL SCALE
Length, inch	•		•	251.		1.509
Max. Width, inch			•	42.8		.257
Max. Depth, inch				59.0		.354
Fineness Ratio		•			•	••
Areas, in. ²						
Max. Cross-	Sectio	nal	•	1828.	•	.0658
Planform				9880.		.356
Wetted		· .	· .	25,400.		.915
Base	•	•:	•	1807.		.0651

MODEL COMPONENT: BODY - HO Tank - T2		Province in the second
GENERAL DESCRIPTION:		·
Blunt cone-cylinder centerline tank w	ith aft boat tail.	
θcone = 10°. Nose radius = 22 in. ful	ll-scale.	
Diameter at base = 274 in. full-scale.		
DRAWING NUMBER:		
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	_2022 in.	12.133 in.
Max. Width Dia. Max. Depth	301_in	1.806 in. 1.806 in.
Fineness Ratio	6.73	6.73
Area		
Max. Cross-Sectional	494 ft ²	2.562 1n. ²
Planform	•••	
Wetted		
Base	422 ft ²	2.125 in. ²

MODEL COMPONENT: BODY - HO Tank - T1		
GENERAL DESCRIPTION:		
Blunt cone-cylinder centerline tank with	aft boat tail.	
θ cone = 15°. Nose radius = 22 in. full-s	cale.	
Diameter at base = 274 in. full-scale.		
DRAWING NUMBER:	<u>-</u>	•
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1867 in.	11.205 in.
Max. Width	301 in.	1.806 in.
D ia. Max. Depth	301 in.	1.806 in.
Fineness Ratio	6.2	6.2
Area		
Max. Cross-Sectional	494 ft ²	2.562 in. ²
Planform		
Wetted		
Base	422 ft ²	2.125 in. ²

MODEL COMPONENT: BODY - HO Tank - T3		
		,
GENERAL DESCRIPTION:		
Blunt cone-cylinder centerline tank with a	ft boat tail.	
θ cone = 10°. Nose radius = 22 in. full-so	cale.	
Diameter at base = 304 in. full-scale.		
	÷ ,	
DRAWING NUMBER:	.	•
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	<u>1914 in.</u>	11.442 in.
Max. Width	323.5 in.	<u>l.941_in.</u>
Dia. Max. Depth	323.5 in.	1.941 fn.
Fineness Ratio	5.92	5.92
Area		
Max. Cross-Sectional	587 ft ²	2.959 in. ²
Planform		
Wetted		
Base	518 ft ²	2.613 in. ²

MODEL COMPONENT: BODY - HO-TANK-T4		
GENERAL DESCRIPTION: Blunt Cone-Cylinde	er Centerline Tank wi	th Aft Boat Tail
θCone = 20°. Nose Radius = 22 In. Full-	Scale. Maximum Diam	eter = 334 In.
Full Scale.		
DRAWING NUMBER:		
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1700 In.	10.200 In.
Max. Width	334 In.	2.004 In.
Dia. Max. Depth	334 In.	_2.004 In.
Fineness Ratio	5.09	5.09
Area		
Max. Cross-Sectional	608 Ft. ²	3.154 In. ²
Planform	and the day.	PR 44 TB
Wetted	en en en en en en en en en en en en en e	
Base	537 Ft. ²	2.785 In. ²

MODEL COMPONENT: TANK VENTRAL FIN, F		•
GENERAL DESCRIPTION: <u>Single Fin Mounte</u> Fin has no movable surface.	d on Tank, T ₄ .	
DRAWING NUMBER:	_	
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Area	337 Ft. ²	1.747 In. ²
Span (equivalent)	237 In.	1.420 In.
Inb'd equivalent chord	323 In.	1.940 In.
Outb'd equivalent chord	87 In.	0.520 In.
Ratio Elevator chord/horizontal tail chord		
At Inb'd equiv. chord		***
At Outb'd equiv. chord	ga up off Spride/Africansprioriessuspel/Africansbrag	
Sweep Back Angles, degrees		
Leading Edge	45	45
Tailing Edge	0	0
Hingeline	gap gab 490 400-400-100 days and 400-400-100-100-100-100-100-100-100-100-	
Area Moment (Normal to hinge line)		

MODEL COMPONENT: BODY - Booster, B		
GENERAL DESCRIPTION: Parallel burn version (RPFB). Blunt come-cylinder with afterbody		
Nose radius = 22 in. full-scale.	Prilipant talkingan (************************************	
DRAWING NUMBER:		•
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1799 in.	10.792 in.
Dia. Body	206 in.	<u>1.236 in.</u>
Max. Dia. Flare	<u>402 in.</u>	2.412 in.
Fineness Ratio	8.73	8.73
Area		
Cross-Sectional (Body)	231 ft ²	1.200 in. ²
Planform	CONTRACTOR OF THE PROPERTY OF	
Wetted		
Base (flare)	901 ft ²	4.539 in. ²

MODEL COMPONENT: CODY - Booster, B S		. :
GENERAL DESCRIPTION: Pressure-Fed Booster		
•		
DRAWING NUMBER:	-	e ere
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1799 In.	10.792 In.
Dia. Body	206 In.	1.236 In.
Max. Dia. Flare	624 In.	3.744 In.
Fineness Ratio	8.73	8.73
Area .	•	•
Max. Cross-Sectional (Body)	_231_Ft ²	1.200_In. ²
Planform	30 50 50	
Wetted	*	
Base (Flare)	2125 Ft ²	11.0093 In. ²

MODEL COMPONENT: CODY - Booster, B ₁ S ₂		
GENERAL DESCRIPTION: Pressure-Fed Booste	er ·	
DRAWING NUMBER:	- -	
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1799 In.	10.792 In.
Dia. Body	206 In.	<u>1.236 In.</u>
Max. Dia. Flare	936.3 In.	5.618 In.
Fineness Ratio	8.73	8.73
Area .		•
Max. Cross-Sectional (Body)	231 Ft ²	1.200 In. ²
Planform		
Wetted	ga da da da manan mangang pagang manan da nadanan	
Base (Flare)	4785 Ft ²	24.7887 In. ²

MODEL COMPONENT: 130DY - Boos	ter - B ₂	
GENERAL DESCRIPTION:		
SRM Booster . Blunt cone-	cylinder. θ cone = 20°. Nose	radius = 16.67 in
full-scale.	Section 11 Section 20	
DRAWING NUMBER:		
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1775 in.	1 <u>0.633 in.</u>
Max. Width Dia.	156 in.	0.936 in.
Max. Depth	156 in.	0.936 in.
Fineness Ratio	11.37	11.37
Area		* * * * * * * * * * * * * * * * * * *
Max. Cross-Sectional	137.8 ft ²	0.694 in. ²
Planform	**	
Wetted	der sp. sp.	
Base	137.8 ft ²	0.694 in. ²

MODEL COMPONENT: BODY - Booster - B2S		
GENERAL DESCRIPTION:		
SRM Booster , B ₂ booster with 15° afterboo	dy flare. Nose ra	dius = 16.67
in. full-scale.		
DRAWING NUMBER:		
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	<u>1775 in.</u>	10.633 in.
Dia. Body	<u>156 in.</u>	<u>0.936 in.</u>
Max. Dia. Flare	275 in.	1.650 in.
Fineness Ratio	11.37	11.37
Area		
Cross Sectional (Body)	137.8 ft ²	0.694 in. ²
Planform		P1 42 40
Wetted	***	
Base (Flare)	428 ft ²	2.158 in. ²

MODEL COMPONENT: BODY - Booster - B3	
GENERAL DESCRIPTION: Parallel burn version of booster (RPFB). Blunt cone-cylinder with after	of recoverable pressure-fed erbody flare. P cone = 15°.
Nose radius - 22 in. full-scale. Θ Flare = 15°	
DRAWING NUMBER:	
DIMENSIONS:	FULL-SCALE MODEL SCALE
Length	1800 in. 10.800 in.
Dia. Body	206 in. 1.236 in.
Max. Dia. Flare	402 in. 2.412 in.
Fineness Ratio	8.74 8.74
Area	
Cross-Sectional (Body)	231 ft ² 1.200 in. ²
Planform	
Wetted	
Base (Flare)	902 ft ² 4.545 in. ²

MODEL COMPONENT: BODY - Booster - B ₄			
GENERAL DESCRIPTION: Parallel burn version	GENERAL DESCRIPTION: Parallel burn version of recoverable pressure-fed		
booster (RPFB). Blunt cone-cylinder with	booster (RPFB). Blunt cone-cylinder with afterbody flare. Ocone = 20°.		
0 flare = 5°. Nose radius = 22 in. full	scale.		
DRAWING NUMBER:			
DIMENSIONS:	FULL-SCALE	MODEL SCALE	
Length	1503 in.	9.025 in.	
Dia. Body	247 in.	1.483 in.	
Max. Dia. Flare	318 in.	1.909 in.	
Fineness Ratio	6.09	6.09	
Area			
Cross-Sectional (Body)	343 ft ²	1.727 in. ²	
Planform	• • •		
Wetted		GA 66 53 Gerard Statement - F. Aberlander Statem	
Base (Flare)	568. ft ²	2.865 in. ²	

HOUSE COMPONENT: Fin, F		
GENERAL DESCRIPTION: Single fin mounted	on each B ₄ booster	flare.
Roll-out angle is 45° down. Fin has no r	movable surface.	· · · · · · · · · · · · · · · · · · ·
		····
		· · · · · · · · · · · · · · · · · · ·
DRAWING NUMBER:	<u>.</u>	y
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Area (exposed planform, 1 fin)	503 ft ²	2.610 in ²
Span (equivalent, to booster &)	424 in	2.544 in
Inb'd equivalent chord	410 in	2.460 in
Outb'd equivalent chord	110 in	0.660 in
Ratio Elevator chord/horizontal tail chord		
At Inb'd equiv. chord		
At Outb'd equiv. chord	,	
Sweep Back Angles, degrees		
Leading Edge	45	45
Tailing Edge	0	0
Hingeline		€7 25 99
Area Moment (Normal to hinge line)	= = =	

MODEL COMPONENT: BODY - Booster, B ₅	·	
GENERAL DESCRIPTION: Pressure-Fed Booster		
DRAWING NUMBER:		
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1799 In.	10.792 In.
Dia. Body Max. Dia. Flare	206 In. 319.3 In.	1.236 In. 1.916 In.
Fineness Ratio	8.73	8.73
Area Max. Cross-Sectional (Body)	231 Ft ²	1.200 In. ²
Planform Wetted		
Base (Flare)	557 Ft ²	2_88 In_2

MODEL COMPONENT: BODY - Booster, B6		·
GENERAL DESCRIPTION: SRM Booster		
DRAWING NUMBER		
DIMENSION:	FULL SCALE	MODEL SCALE
Length	1613 in.	9.673 in.
Dia. (Body)	156 in.	0.936 in
Max Depth	156 in.	0.936 in.
Fineness Ratio	10.35	10.35
Area		
Max Cross-Sectional	137.8 ft ²	0.694 in ²
Planform		
Wetted	** ** **	•••
Base (Nozzle)	95.4 ft ²	0.481 in ²

MODEL COMPONENT: BODY - Booster, B,		~~~
GENERAL DESCRIPTION: 120" Dia. SRM		
DRAWING NUMBER:	•	
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	1403 In.	8.418 In.
Dia. Body	120 In.	_0.72 In.
Max. Dia. Flare	tio da co	
Fineness Ratio	11.7	11.7
Area .		•
Max. Cross-Sectional (Body)	79.3 Ft ²	0.408 In. ²
Planform .		
Wetted	•	
Base	79.3 Ft ²	0.408 In. ²

TABLE 3. (CONCLUDED)

MODEL COMPONENT: BODY - TVC Tank Al for	B ₇ ·	
GENERAL DESCRIPTION: Thrust Vectoring Fue	el Tank	

DRAWING NUMBER:	<u>-</u>	. • •
DIMENSIONS:	FULL-SCALE	MODEL SCALE
Length	381.8 In.	2.291 In
Dia. Body	42 In.	0.252 In
Max. Dia. Flare	Company of the Compan	
Fineness Ratio	9.08	9.08
Area .		
Max. Cross-Sectional (Body)	9.65 Ft ²	0.05 In. ²
Planform		
Wetted		
Base	• • •	the the top

TABLE 4.
Plume Definition

M = 1.5

	B ₁	B ₆		0, (3 Eng.	-HiPc)
r _e =	187 in.	r e = 6	6 in.	r _e = 92	.5 in.
x/r _e	r/r _e	x/r _e	r/r _e	x/r _e	r/r _e
0 0.5 1.0 1.5 2.0	1.00 1.17 1.22 1.23 1.20	0 0.5 1.0 1.5 2.0 2.5 3.0	1.00 1.23 1.48 1.70 1.88 2.00 2.11	0 0.5 1.0 1.5 2.0	1.0 1.0 1.0 1.0

M = 2.2

B ₆	;	0 ₁ (3 En	gHiPc)
	66 in.	r _e = 1	18 in.
x/r _e	r/r _e	x/r _e	r/r _e
0	1.00	0	1.00
0.5	1.33	0.5	1.10
1.0	1.62	1.0	1.20
1.5	1.88	1.5	1.26
2.0	2.13	2.0	1.33
2.5	2.33	2.5	1.41
3.0	2.51	3.0	1.47
4.0	2.84	4.0	1.57
5.0	3.12	5.0	1.62
6.0	3.35	6.0	1.65
7.0	3.55	7.0	1.66
8.0	3.72	8.0	1.64
9.0 10.0	3.87		
11.0	3.97		
12.0	4.03 4.11	•	
13.0	4.15		
14.0	4.15		

TABLE 4, cont.

M = 2.5

$\mathbf{r}_{e} \stackrel{\mathbf{B}_{1}}{=}$	187 in.		· () <u>1 (4 E</u>	ngJ2S) = 89 in.
x/r_e	r/r_e			x/r_e	r/r_e
0 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	1.00 1.34 1.53 1.77 1.91 2.03 2.13 2.30 2.30 2.23			0 0.5 1.0 1.5 2.0 2.5 3.0 4.0 5.0	1.00 1.21 1.34 1.46 1.56 1.61 1.67 1.71
М	= 1.5	 37_		M	= 2.2
${f r}_{f e}$	= 60 in.	•		re	= 60 in.
x/r _e	r/r_e			x/r_e	$r/r_{\rm e}$
0 0.026 0.100 0.240 0.320 0.430 0.680 1.000 1.400 1.870 2.430 3.410 4.150 4.970 5.830	1.00 1.01 1.05 1.10 1.14 1.18 1.27 1.34 1.50 1.61 1.72 1.87 1.94 1.98 2.00			0 0.04 0.17 0.23 0.30 0.38 0.48 0.58 0.70 0.83 1.13 1.30 1.69 2.13 2.64 3.87 4.58 5.36	1.00 1.02 1.09 1.12 1.16 1.20 1.24 1.29 1.34 1.40 1.52 1.60 1.73 1.87 2.02 2.17 2.31 2.45 2.57

TABLE 5.

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Longitudinal Effects of a Bl Booster on (O1)TLB1 at Beta = 0	А	Ascent Configuration Booster Isolation	1/1-50
Longitudinal Effects of a Bl Booster on (O1)TLBL at Beta = 6	A	Ascent Configuration Booster Isolation	1/51-80
<pre>Lateral-Directional Effects of a Bl Booster on (01)TlBl at Beta = 0</pre>	₩	Ascent Configuration Booster Isolation	1/81-95
Lateral-Directional Effects of a Bl Booster on (01)扣Bl at Beta = 6	ㅂ	Ascent Configuration Booster Isolation	1/96-104
<pre>Iateral-Directional Effects of a Bl Booster on (01)TLBl with Beta at Alpha = 0</pre>	Ð	Ascent Configuration Booster Isolation	1/105-110
<pre>Longitudinal Effects of a Bl Booster on (01)TIBl with Beta at Alpha = 0</pre>	ᅜ	Ascent Configuration Booster Isolation	1/111-120
Effect of Beta on Longitudinal Characteristics of OlTLB1	А	Beta	1/121-180
Effect of Beta on Lateral-Directional Characteristics of OlTLB1	ᅜ	Beta	1/181-198
Lateral-Directional Characteristics of Configuration OlTLBL with Beta at Alpha = 0	G ,		1/199-218
Aileron Effectiveness of Configuration (O1)TlBl at Beta =	о В	Aileron Deflection	1/219-236
Aileron Effectiveness of Configuration OlTIB1 at Beta = 0	ㅂ	Aileron Deflection	1/237-239
Variation of Aileron Control at Alpha = 0 with Beta of OlTIBL	a	Aileron Deflection	1/240-243
<pre>Longitudinal Effects of a B2 Booster on (01)TLB2 at Beta = 6</pre>	A	Ascent Configuration Booster Isolation	1/244-303

TABLE 6. (CONTINUED)

	1/570-579	Ascent Configuration Booster Isolation	ਦ	Longitudinal Effects of a B3 Booster on (O1)TlB3 with Beta at Alpha = O
***	1/564-569	Ascent Configuration Booster Isolation	D	Lateral-Directional Effects of a B3 Booster on (O1)TlB3 with Beta at Alpha = 0
	1/558-563	Ascent Configuration Booster Isolation	₩	Lateral-Directional Effects of a B3 Booster on (O1)TlB3 at Beta = 6
F	1/546-557	Ascent Configuration Booster Isolation	В	Lateral-Directional Effects of a B3 Booster on (O1)T1B3 at Beta = 0
	1/526-545	Ascent Configuration Booster Isolation	А	<pre>Longitudinal Effects of a B3 Booster on (01)T1B3 at Beta = 6</pre>
69	1/466-525	Ascent Configuration Booster Isolation	А	Longitudinal Effects of a B3 Booster on (01)TlB3 at Beta = 0
	1/448-465	Beta	ᅜ	Effect of Beta on Lateral-Directional Characteristics of OlTLB2S
	1/388-447	Beta	A	Effect of Beta on Longitudinal Characteristics of OlTIB2S
·	1/370-387	Beta	ᅜ	Effect of Beta on Lateral-Directional Characteristics of OlTLB2
	1/310-369	Beta	A	Effect of Beta on Longitudinal Characteristics of OlTLB2
	I/304-309	Ascent Configuration Booster Isolation	В	Lateral-Directional Effects of a B2 Booster on (01)T1B2 at Beta = 6
	VOLUME/ PAGE NO.	CONDITIONS VARYING	PLOTTED COEFFICIENTS SCHEDULE	TITLE

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TTTT	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Longitudinal Effects of a B4 Booster on (01)TlB4 at Beta = 0	A	Ascent Configuration Booster Isolation	1/580-639
Longitudinal Effects of a B4 Booster on (01)TlB4 at Beta = 6	A	Ascent Configuration Booster Isolation	1/640-659
<pre>Lateral-Directional Effects of a B4 Booster on (01)TlB4 at Beta = 0</pre>	₩	Ascent Configuration Booster Isolation	1/660-674
<pre>Lateral-Directional Effects of a B4 Booster on (01)TlB4 at Beta = 6</pre>	₩	Ascent Configuration Booster Isolation	1/675-680
Iateral-Directional Effects of a B4 Booster on (O1)TlB4 with Beta at Alpha = O	מ	Ascent Configuration Booster Isolation	1/681-689
Longitudinal Effects of a B4 Booster on (O1)TlB4 with Beta at Alpha = O	Ħ	Ascent Configuration Booster Isolation	1/690-704
Longitudinal Effects of a B5 Booster on (01)T1B5 at Beta = 6	A	Ascent Configuration Booster Isolation	1/705-724
Lateral-Directional Effects of a B5 Booster on (01)TlB5 at Beta = 6	В	Ascent Configuration Booster Isolation	1/725-730
<pre>Longitudinal Effects of a B5 Booster on (OlV1)TlB5 at Beta = 0</pre>	A	Ascent Configuration Booster Isolation	1/731-790
<pre>Longitudinal Effects of a B5 Booster on (OLV1)TLB5 at Beta = 6</pre>	А	Ascent Configuration Booster Isolation	1/791-800
Lateral-Directional Effects of a B5 Booster on (O1V1)TLB5 at Beta = 0	₩	Ascent Configuration Booster Isolation	1/801-812
Lateral-Directional Effects of a B5 Booster on (OlV1)TlB5	В	Ascent Configuration Booster Isolation	1/813-815
Lateral-Directional Effects of a B5 Booster on (OlV1)TlB5 with Beta at Alpha = 0	D	Ascent Configuration Booster Isolation	1/816-824

TABLE 6. (CONTINUED)

1/948-959	Configuration	C	<pre>Tank Nose Cone Effect on Lateral-Directional Characteristics of Configuration (OlV1)T1B5 at Alpha = 0 /</pre>
1/918-947	Configuration	А	Tank Nose Cone Effect on Longitudinal Characteristics of Configuration (OlV1)TLB5 at Beta = O
1/915-917	Ascent Configuration Booster Isolation	В	Lateral-Directional Effects of a Bl Booster on (O1)T2Bl at Beta = 6
1/905-914	Ascent Configuration Booster Isolation	А	<pre>Longitudinal Effects of a Bl Booster on (01)T2Bl at Beta = 6</pre>
1/875-904	Configuration	A	Tank Nose Cone Effect on Longitudinal Characteristics of Configuration (01)TlBl at Beta = 0
1/870-874	Mach No.	Ħ	<pre>Longitudinal Characteristics of (01)TLB6 with Ailerons = 20 at Alpha = 0</pre>
1/867-869	Mach No.	U	Lateral-Directional Characteristics of (01)T1B6 with Allerons = 20 at Alpha = 0
1/864-866	Mach No.	뀽	Lateral-Directional Characteristics of (01)T1B6 with Ailerons = 20 at Beta = 0
1/854-863	Mach No.	A	Longitudinal Characteristics of (O1)TIB6 with Ailerons = 20 at Beta = 0
1/850-853	Mach No.	Ω	Lateral-Directional Characteristics of (O1)T1B6 at Alpha = 0
1/840-849	Mach No.	Α	Longitudinal Characteristics of (O1)T1B6 at Beta = O
1/825-839	Ascent Configuration Booster Isolation	병	<pre>Longitudinal Effects of a B5 Booster on (01V1)T1B5 with Beta at Alpha = 0</pre>
VOLUME/ PAGE NO.	CONDITIONS VARYING	PLOTTED COEFFICIENTS SCHEDULE	С
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TABLE 6. (CONTINUED)

<pre>Lateral-Directional Effects of a Bl Booster on (01)T3Bl with Beta at Alpha = 0</pre>	<pre>lateral-Directional Effects of a Bl Booster on (01)T3Bl at Beta = 6</pre>	<pre>Iateral-Directional Effects of a Bl Booster on (01)T3Bl at Beta = 0</pre>	<pre>Longitudinal Effects of a Bl Booster on (01)T3Bl at Beta = 6</pre>	<pre>Longitudinal Effects of a Bl Booster on (01)T3Bl at Beta = 0</pre>	Effect of Tank T2 Longitudinal Position on (OlVI)T2B5 with Beta at Alpha = 0	Effect of Tank T2 Longitudinal Position on (OlV1)T2B5 with Beta at Alpha = O	Effect of Tank T2 Longitudinal Position on (OlV1)T2B5 at Beta = 0	<pre>Effect of Tank T2 Longitudinal Position on (01V1)T2B5 at Beta = 0</pre>	Lateral-Directional Effects of a Bl Booster on (O1)T2ABl at Beta = 6	Longitudinal Effects of a Bl Booster on (O1)T2ABl at Beta = 6	Effect of Tank T2 Longitudinal Position on (01)T2B1 at Beta = 0	TITLE
Ð	ᅜ	ᅜ	А	А	a	G	А	А	ᅜ	А	Α	PLOTTED COEFFICIENTS SCHEDULE
Ascent Configuration Booster Isolation	Ascent Configuration Booster Isolation	Ascent Configuration Booster Isolation	Ascent Configuration Booster Isolation	Ascent Configuration Booster Isolation	Configuration	Configuration	Configuration	Configuration	Ascent Configuration Booster Isolation	Ascent Configuration Booster Isolation	Configuration	CONDITIONS VARYING
11/79-84	11/73-78	11/61-72	11/41-60	11/1-40	1/1075-1082	1/1063-1074	1/1033-1062	1/1003-1032	1/1000-1002	1/990=999	1/960-989	VOLUME/ PAGE NO.

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don II/100-139 don II/140-151 don II/152-157 don II/158-167 III/168-177 II/188-190 ion II/231-240 ion II/241-252	Ascent Configuration Booster Isolation Ascent Configuration Ascent Configuration Ascent Configuration Booster Isolation Ascent Configuration Booster Isolation Mach No. Mach No. Mach No. Ascent Configuration Booster Isolation Ascent Configuration Ascent Configuration Ascent Configuration Ascent Configuration Booster Isolation Booster Isolation	B A B A E C B A	Iongitudinal Effects of a B2 Booster on (O1)T3B2 at Beta = 0 Iateral-Directional Effects of a B2 Booster on (O1)T3B2 at Beta = 0 Iateral-Directional Effects of a B2 Booster on (O1)T3B2 with Beta at Alpha = 0 Iongitudinal Effects of a B2 Booster on (O1)T3B2 with Beta at Alpha = 0 Iongitudinal Characteristics of Configuration O1T3B2 at Beta = 6 Iongitudinal Characteristics of Configuration O1T3B2 at Beta = 6 Iateral-Directional Characteristics of Configuration O1T3B2 at Beta = 6 Iongitudinal Effects of a B3 Booster on (O1)T3B3 at Beta = 0 Iongitudinal Effects of a B3 Booster on (O1)T3B3 at Beta = 6 Iateral-Directional Effects of a B3 Booster on (O1)T3B3 at Beta = 0
PAGE NO. 11/85-99	VARYING Ascent Configuration	SCHEDULE E	Effects of

TABLE 6. (CONTINUED)

TITIE	PLOTTED SCHEDULE SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Lateral-Directional Effects of a B3 Booster on (01)T3B3 with Beta at Alpha = 0	Đ	Ascent Configuration Booster Isolation	11/256-261
Longitudinal Effects of a B3 Booster on (01)T3B3 with Beta at Alpha = 0	ਸ਼	Ascent Configuration Booster Isolation	11/262-271
B3 Boosters Contribution to Longitudinal Characteristics of (O1)T3B3 at Beta = 0	A	Configuration	11/272-321
B3 Boosters Contribution to Lateral-Directional Characteristics of (O1)T3B3 at Alpha = 0	C	Configuration	II/322-333
Effect of Beta on Longitudinal Characteristics of OlT3B4	А	Beta	II/334-394
Effect of Beta on Lateral-Directional Characteristics of OlT3B4	ᅜ	Beta	11/394-411
Iateral-Directional Characteristics of OlT3B4 with Beta at Alpha = 0 and 6	a	Alpha	II/412-435
Lateral-Directional Characteristics of Configuration (O1)T3B4 with Beta at Alpha = O	a		11/436-439
Aileron Effectiveness of Configuration OlT3B4 at Beta = O	₩	Aileron Deflection	11/440-457
Aileron Effectiveness of Configuration (O1)T3B4 at Beta = 0	ㅂ	Aileron Deflection	II/458-460
Effects of Alpha on Rudder Effectiveness of Configuration OlT3B4 at Beta = O	В	Rudder Deflection	11/461-478
Effects of Alpha on Rudder Effectiveness of Configuration (O1)T3B4 at Beta = 0	₩	Rudder Deflection	11/479-481
Effect of Booster Fin F4 on Longitudinal Characteristics of OlT3F4 at Beta = 0	A	Configuration	11/482-541

TABLE 6. (CONTINUED)

TITLE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Effect of Booster Fin F4 on Longitudinal Characteristics of (01)T3B4 at Beta = 0	А	Configuration	11/542-551
Effect of Booster Fin F4 on Longitudinal Characteristics of (01)T3B4 at Beta = 6	·A	Configuration	11/552-611
Effect of Booster Fin F4 on Lateral-Directional Characteristics of (O1)T3B4 at Beta = 6	ង	Configuration	11/612-629
<pre>Longitudinal Effects of a B5 Booster on (OlV1)T3B5 at Beta = 0</pre>	А	Ascent Configuration Booster Isolation	11/630-669
<pre>Longitudinal Effects of a B5 Booster on (OlV1)T3B5 at Beta = 6</pre>	А	Ascent Configuration Booster Isolation	11/670-679
<pre>Lateral-Directional Effects of a B5 Booster on (OLVI)T3B5 at Beta = 0</pre>	ᅜ	Ascent Configuration Booster Isolation	11/680-691
Iateral-Directional Effects of a B5 Booster on (OlVI)T3B5 at Beta = 6	₩	Ascent Configuration Booster Isolation	11/692-694
<pre>Lateral-Directional Effects of a B5 Booster on (OlV1)T3B5 with Beta at Alpha = 0</pre>	Đ	Ascent Configuration Booster Isolation	II/695-700
Iongitudinal Effects of a B5 Booster on (OlV1)T3B5 with Beta at Alpha = O	Ħ	Ascent Configuration Booster Isolation	11/701-710
Effects of Beta on Longitudinal Characteristics of (O1)T4B7A1-4	А	Beta	III/1-60
Effects of Beta on Lateral-Directional Characteristics of (01)T4B7Al-4	В	Beta,	III/61-78

TABLE 6. (CONTINUED)

TITE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Longitudinal Characteristics of Configuration OlT4B7Al-4 at Beta = O	А	Mach No.	III/79-88
Lateral-Directional Characteristics of Configuration OlT4B7Al-4 at Alpha = O	a	Mach No.	111/89-92
Aileron Effectiveness of Configuration (01)T4B7Al-4 at Beta = 0	В	Aileron Deflection	III/93-110
Aileron Effectiveness of Configuration (O1) $T4B7A1-4$ at Beta = 6	₽	Aileron Deflection	111/111-128
Effects of Beta on Aileron Control of Configuration (01)T4B7A1-4 at Alpha = 0	C	Aileron Deflection	111/129-152
Effects of Aileron on Longitudinal Characteristics of Configuration (O1) $T4B7A1-4$ at Beta = 6	А	Aileron Deflection	III/153-212
Effects of Alpha on Rudder Control of Configuration (01)T4B7Al-4 at Beta = 0	В	Rudder Deflection	III/213-230
Rudder Effectiveness of Configuration (O1)T4B7A1-4 at Alpha = O	C	Rudder Deflection	III/231-254
Effects of Beta on Lateral-Directional Characteristics of (01)T4B7Al-4 with Rudder = 10	뮹	Beta	III/255-272
Effects of Al on Longitudinal Characteristics of (01)T4B7Al-4 at Beta = 0	А	Configuration	III/273-302
Effects of Al on Lateral-Directional Characteristics of (O1)T4B7A1-4 at Alpha = O	a	Configuration	111/ 3 03-314
Effects of Fin Fl on Longitudinal Characteristics_of Configuration OlT4B7Al-4 at Beta = 0	A	Configuration	III/315-334

TABLE 6. (CONTINUED)

TITLE	PLOTTED SCHEDULE SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Effects of Fin F1 on Lateral-Directional Characteristics on Configuration OlT4B7Al-4 at Alpha = O	C	Configuration	III/335-342
Effects of Fin Fl on Longitudinal Characteristics of Configuration T4B7Al-4 at Beta = 0	A	Configuration	III/343-402
Effects of Fin Fl on Lateral-Directional Characteristics on Configuration T4B7Al-4 at Alpha = 0	Q	Configuration	III/403-426
Effects of B7Al- $^{\downarrow}$ on Longitudinal Characteristics of Configuration (Ol)T $^{\downarrow}$ B7Al- $^{\downarrow}$ at Beta = 0	А	Configuration	III/427-486
Effects of B7Al-4 on Lateral-Directional Characteristics of Configuration (O1)T4B7A-1 at Alpha = 0	a	Configuration	III/487-510
Comparison of the Longitudinal Characteristics of (01)T4B7A1-4 and (01)T4B7A1-5 at Beta = 0	A	Configuration	III/511-570
Comparison of the Lateral-Directional Characteristics of (01)T4B7A1-4 and (01)T4B7A1-5 at Beta = 6	В	Configuration	111/571-588
Comparison of the Lateral-Directional Characteristics of (01)T4B7Al-4 and (01)T4B7Al-5 at Alpha = 0	a	Configuration	111/589-612
Effects of Beta on Longitudinal Characteristics of (01)T4B7A1-5	А	Beta	111/613-672
Effects of Beta on Lateral-Directional Characteristics of (01)T4B7A1-5	₩	Beta	III/673-690
Longitudinal Effect of Exhaust Plumes on Configuration OlTlBl at Beta = O	А	Plume	IV/ 1-20
Longitudinal Effect of Exhaust Plumes on Configuration OlTlBl at Beta = 6	А	Plume	IV/21-30

TABLE 6. (CONTINUED)

	IV/96-105		А	Iongitudinal Characteristics of Configuration OlTLB1+Plume(2.5) with Deflected Rudder at Beta = 0
	IV/93-95		ㅂ	OlTLB1 + Plume(2.5) with Deflected Rudder at Beta = 0
	IV/85-92	Plume and Rudder Deflection	a	Effects of M=1.5 Exhaust Plumes on Rudder Effectiveness with Beta at Alpha = 0 of OlTLBl
	IV/79-84	Plume and Rudder Deflection	뀽	Variation of Rudder Control at Beta = 0 with Alpha and M=1.5 Exhaust Plumes OlTlBl
78	IV/71-78	Plume and Aileron Deflection	a	Variation of Aileron Control at Alpha = 0 with Beta and M=1.5 Exhaust Plumes OlTlBl
	IV/65-70	Plume and Aileron Deflection	₩	<pre>Effects of M=1.5 Exhaust Plumes on Aileron Effectiveness of Configuration OlfIBl at Beta = 0</pre>
	IV/62-64	Plume	₩	Effect of Exhaust Plumes on Aileron Effectiveness of Configuration OlTLB1 on Beta = 0
	1V/54-61	Plume	a	Lateral-Directional Effect of M=1.5 Exhaust Plumes on Configuration OlTLB1 at Alpha = 0
	IV/34-53	P1ume	А	Longitudinal Effect of M = 1.5 Exhaust Plumes on Configuration OlTIBL at Beta = 0
	IV/31-33	P1ume	₩	Lateral-Directional Effect of Exhaust Plumes on Configuration OlTIBL at Beta = 6
	VOLUME/ PAGE NO.	CONDITIONS VARYING	PLOTTED COEFFICIENTS SCHEDULE	TTTLE

TABLE 6. (CONTINUED)

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TTTLE	COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Longitudinal Effect of Mach No=2.2 Exhaust Plumes on Configuration OlT3B6 at Beta = O	А	P1 ume	IA/116-152
Lateral-Directional Effect of Mach No.=1.5 Exhaust Plumes on Configuration OlT3B6 at Alpha = 0	es · C	Plume	IV/126-129
<pre>Lateral-Directional Effect of Mach No=2.2 Exhaust Plumes on Configuration OlT3B6 at Alpha = 0</pre>	ts C	Plume	IV/130-133
Effects of M=1.5 Exhaust Plumes on Aileron Effectiveness of Configuration OlT3B6 at Beta = 0	В	Plume and Aileron Deflection	10/134-136
Effects of M=2.2 Exhaust Plumes on Aileron Effectiveness of Configuration OlT3B6 at Beta = 0	8	Plume and Aileron Deflection	IV/137-139
Variation of Aileron Control at Alpha = 0 with Beta and M=1.5 Exhaust Plumes OlT3B6	α	Plume and Aileron Deflection	IV/140-143
Variation of Aileron Control at Alpha = 0 with Beta and M=2.2 Exhaust Plumes OlT3B6	Ω	Plume and Aileron Deflection	1V/144-147
Variation of Rudder Control at Beta = 0 with Alpha and M=1.5 Exhaust Plumes 01T3B6	В	Plume and Rudder Deflection	IV/148-150
Effects of M=1.5 Exhaust Plumes on Rudder Effectiveness with Beta at Alpha = 0 of OlT3B6	C	Plume and Rudder Deflection	IV/151-154
Variation of Rudder Control at Beta = 0 with Alpha and M=2.2 Exhaust Plumes 01T3B6	В	Plume and Rudder Deflection	IV/155-157
<pre>Effects of M=2.2 Exhaust Plumes on Rudder Effectiveness with Beta at Alpha = 0 of OlT3B6</pre>	a	Plume and Rudder Deflection	IV/158-161
Iongitudinal Effect of M=1.5 Exhaust Plumes on Configuration OlT4B7Al-4 at Beta = 0	А	Plume	IV/162-171

ABLE 6. (CONTINUED)

F	PLOTTED		
TITILE S	COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Longitudinal Effect of M=2.2 Exhaust Plumes on Configuration OlT4B7Al-4 at Beta = O	А	Plume	IV/172-181
Lateral-Directional Effects of M=1.5 Exhaust Plumes on Configuration OlT4B7Al-4 at Alpha = O	a	Plume	IV/182-185
Lateral-Directional Effects of M=2.2 Exhaust Plumes on Configuration OlT4B7Al-4 at Alpha = O	a	Plume	IV/186-189
Aileron Effectiveness of Configuration OlT4B7Al-4+Plume(1.5) at Beta = 0	В	Aileron Deflection	IV/190-192
Aileron Effectiveness of Configuration OlT4B7Al-4+Plume(2.2) at Beta = 0	В	Aileron Deflection	IV/193-195
Effects of Beta on Aileron Control of Configuration $OlT^{\mu}B7Al^{-\mu+Plume}(1.5)$ at Alpha = 0	Ω	Aileron Deflection	IV/196-199
Effects of Beta on Alleron Control of Configuration $OlT^{\mu}B7Al^{-\mu+Plume}(2.2)$ at Alpha = 0	Q	Aileron Deflection	IV/200-203
Rudder Effectiveness of Configuration OlT4B7Al-4+Plume(1.5) at Alpha = O	C	Rudder Deflection	IV/204-207
Rudder Effectiveness of Configuration OlT4B7Al-4+Plume(2.2) at Alpha = 0	Ω	Rudder Deflection	IV/208-211
Effects of Alpha on Rudder Control of Configuration OlT4B7Al-4+Plume(1.5) at Beta = 0	쓩	Rudder Deflection	IV/212-214
Effects of Alpha on Rudder Control of Configuration OlT4B7Al-4+Plume(2.2) at Beta = 0	₩	Rudder Deflection	IV/215-217

TABLE 6. (CONTINUED)

Longitudinal Characteristics Comparison of Vl and V2 on E Configuration IV/337- (01)Tl at Alpha = 0	Lateral-Directional Characteristics of V1 and V2 on (O1)T1 D Configuration IV/328-	Effects of Beta = 6 on Lateral-Directional Characteristics B Beta of Configuration (01)Tl	Effects of Beta = 6 on Longitudinal Characteristics of A Beta IV/302-; Configuration (O1)T1	A Plume, Rudder Deflection, Rudder Flare	Variation of Rudder Control with and Without Rudder A Plume, Rudder Deflection, IV/262-2 Flare and M=1.5 Exhaust Plume	Effects of M=2.2 Exhaust Plumes on Rudder Effectiveness C Plume, Rudder Deflection, IV/254-2 with and without Rudder Flare	Effects of M=1.5 Exhaust Plumes on Rudder Effectiveness C Plume, Rudder Deflection, IV/246-2 with and without Rudder Flare	Lateral-Directional Effects of M=2.2 Exhaust Plumes on C Plume TV/242-2 Configuration OlVlT4B7Al-4 at Alpha = 0	Iongitudinal Effects of M=2.2 Exhaust Plumes on A Plume IV/232-2 Configuration OlVIT4B7Al-4 at Beta = 0	Lateral-Directional Effects of M=1.5 Exhaust Plumes C Plume IV/228-i on Configuration OlVlT4B7Al-4 at Alpha = O	Longitudinal Effects of M=1.5 Exhaust Plumes on A Plume IV/218-Configuration OlVLT4B7Al-4 at Beta = 0	TITLE CONDITIONS VOLUME/ SCHEDULE VARYING PAGE NO
IV/337-351	IV/328-336	IV/322-327	IV/302-321	IV/282-301	IV/262-281	IV/254-261	IV/246-253	IV/242-245	IV/232-241	IV/228-231	IV/218-227	VOLUME/ PAGE NO.

TABLE 6. (CONTINUED)

	עיניתנייט		
TITLE	SCHEDULE SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Aileron Effectiveness of Configuration (OlV1)T1 at Beta = 0	₩	Aileron Deflection	IV/352-360
Effects of Beta on Aileron Effectiveness of Configuration (OLVI)Tl at Alpha = O	IJ	Aileron Deflection	IV/361-369
Iongitudinal Characteristics of (OlV1)TI with Ailerons=20 at Beta = 0	A	Mach No.	IV/370-379
Lateral-Directional Characteristics of (O1V1)T1 with Allerons = 20 at Beta = 0	В	Mach No.	IV/380-382
Lateral-Directional Characteristics of (OlVI)Tl with Ailerons = 20 at Alpha = 0	Ð	Mach No.	IV/383-385
Iongitudinal Characteristics of (OlVI)TI with Ailerons=20 at Alpha = 0	চ্য	Mach No.	īv/386-390
Rudder Effectiveness of Configuration (OlV1)T1 at Alpha = 0	С	Rudder Deflection	IV/391-402
Effects of Alpha on Rudder Effectiveness of Configuration (O1V1)T1 at Beta = 0	В	Rudder Deflection	IV/403-411
Effect of Tank T2 Longitudinal Position on (01)T2 at Beta=0	O A	Configuration	IV/412-431
Effect of Tank T2 Longitudinal Position on (01)T2 with Beta at Alpha = 0	a	Configuration	IV/432-439
Longitudinal Characteristics of Various Boosters on Configuration (O1)T2 at Beta = 6	A	Configuration	644-044/AI
<pre>Lateral-Directional Characteristics of Various Boosters on Configuration (01)T2 at Beta = 6</pre>	В	Configuration	IV/450-452

TABLE 6. (CONTINUED)

TITLE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.	
Effects of Beta = 6 on Longitudinal Characteristics of Configuration (O1)T3	А	Beta	IV/453-472	
Effects of Beta = 6 on Lateral-Directional Characteristics of Configuration (01)T3	8	Beta	IV/473-478	. •
Effects of Beta on Longitudinal Characteristics of (O1)T4	÷ A	Beta	IV/479-488	•
Effects of Beta on Lateral-Directional Characteristics of (O1)T4	В	Beta	IV/489-491	
Longitudinal Characteristics of Configuration TlB5 at Beta = 0	. Þ	Mach No.	IV/492-501	
Lateral-Directional Characteristics of Configuration T1B5 at Alpha = 0	a	Mach No.	IV/502-505	3
Longitudinal Characteristics of Configuration TLB6 at Beta = 0	A	Mach No.	IV/506-515	8.
Lateral-Directional Characteristics of Configuration TLB6 at Alpha = 0	C	Mach No.	IA/216-219	(
Longitudinal Characteristics of Configuration T3B2 at Beta = 0	А	Mach No.	IV/520-529	
Lateral-Directional Characteristics of Configuration T3B2 at Alpha = 0	C	Mach No.	IV /530-533	
Longitudinal Characteristics of Configuration T3B5 at Beta = 0	А	Mach No.	IV /534-543	
Lateral-Directional Characteristics of Configuration T3B5 at Alpha = 0	a	Mach No.	IV /544-547	

TABLE 6. (CONTINUED)

TITIE	PLOTTED COEFFICIENTS SCHEDULE	CONDITIONS VARYING	VOLUME/ PAGE NO.
Effects of Beta on Longitudinal Characteristics of Ol	Α	Beta.	V/1-60
Effects of Beta on Lateral-Directional Characteristics of Ol	ᅜ	Beta	v/61-78
Effects of Alpha on Rudder Effectiveness of Configuration Ol at Beta = 0	ᅜ	Rudder Deflection	v/79-90
Effects of Alpha on Rudder Effectiveness of Configuration OlVI	ᅜ	Rudder Deflection	v/91-93
Effects of Beta on Longitudinal Characteristics of OlVI	A	Beta	V/94-123
Effects of Beta on Lateral-Directional Characteristics of OlV1	ᅜ	Beta	V/124-132
Effects of Beta on Longitudinal Characteristics V Off	А	Beta	V/133-162
Effects of Beta on Lateral-Directional Characteristics of Ol V Off	ㅂ	Beta	v/163-171
Effects of Beta on Lateral-Directional Characteristics of OlCl	ᅜ	Beta	V/172-186
Effects of Beta on Lateral-Directional Characteristics of OlCl	뮹	Beta	v/187-201
Longitudinal Characteristics of Various Tanks at Beta = 0	А	Configuration	V/202-261
Iongitudinal Characteristics of Various Boosters Alone at Beta = 0 and Nominal MRC	A	Configuration	V/262-301

TABLE 6. (CONTINUED)

TTTLE	PLOTTED COEFFICIENTS	CONDITIONS VARYING	VOLUME/ PAGE NO.
Longitudinal Characteristics of Various Boosters Alone at Beta = 0 and Tank 1 MRC	⊅	Configuration	v/302-341
Iongitudinal Characteristics of Various Boosters Alone at Beta = 0 and Tank 3 MRC	Α	Configuration	v/342-381
<pre>Lateral-Directional Characteristics of Various Boosters Alone at Beta = 0 and Tank 1 MRC</pre>	뮹	Configuration	₹/382-393
Lateral-Directional Characteristics of Various Boosters Alone at Beta = 0 and Tank 3 MRC	ᅜ	Configuration	₹/394-405
Lateral-Directional Characteristics of Various Boosters Alone at Alpha = 0 and Nominal MRC	. α	Configuration	V/406-421
Lateral-Directional Characteristics of Various Boosters Alone at Alpha = 0 and Tank 1 MRC	a	Configuration	V/422-437
Lateral-Directional Characteristics of Various Boosters Alone at Alpha = 0 and Tank 3 MRC	α	Configuration	V/438-453
Comparison of Longitudinal Characteristics of Booster Bl with Larger Aft Flares S	А	Configuration	V/454-523
Comparison of Longitudinal Characteristics of Booster Bl with Flaps D2 at Various Deflection	А	Flap Deflection	v/524-583
Comparison of Longitudinal Characteristics of Booster Bl with Various Flaps	А	Flap Deflection	v/584-643

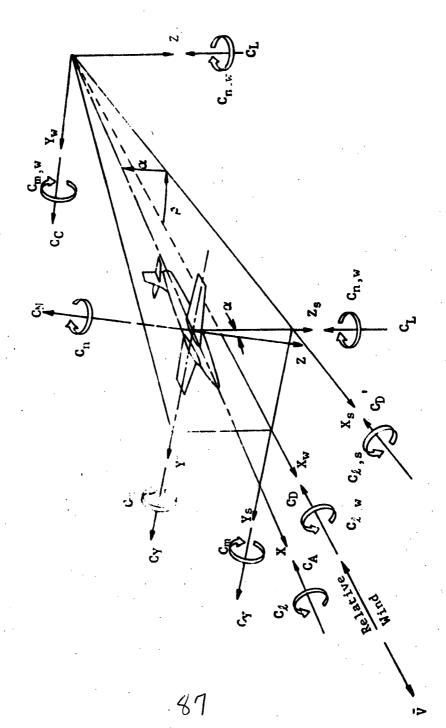
TABLE 6. (CONCLUDED)

PLOTTED COEFFICIENTS SCHEDULE:

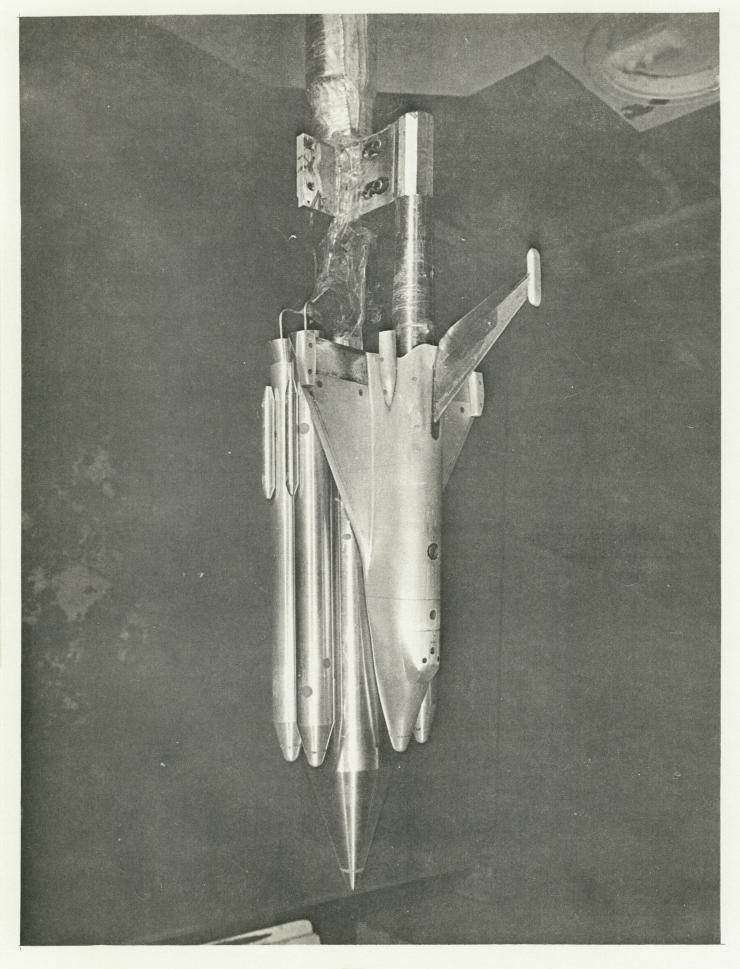
- (A) CN, CA, CAF, CLM, CL & CDF vs. ALPHA
 CN & CL vs. CLM, CL & CLSQR vs. CDF
- (B) CY, CYN & CBL vs. ALPHA
- (C) CY, CYN, CBL & CAF vs. BETA
- (D) CY, CYN, CBL vs. BETA
- (E) CN, CAF, CLM, CL & CDF vs. BETA

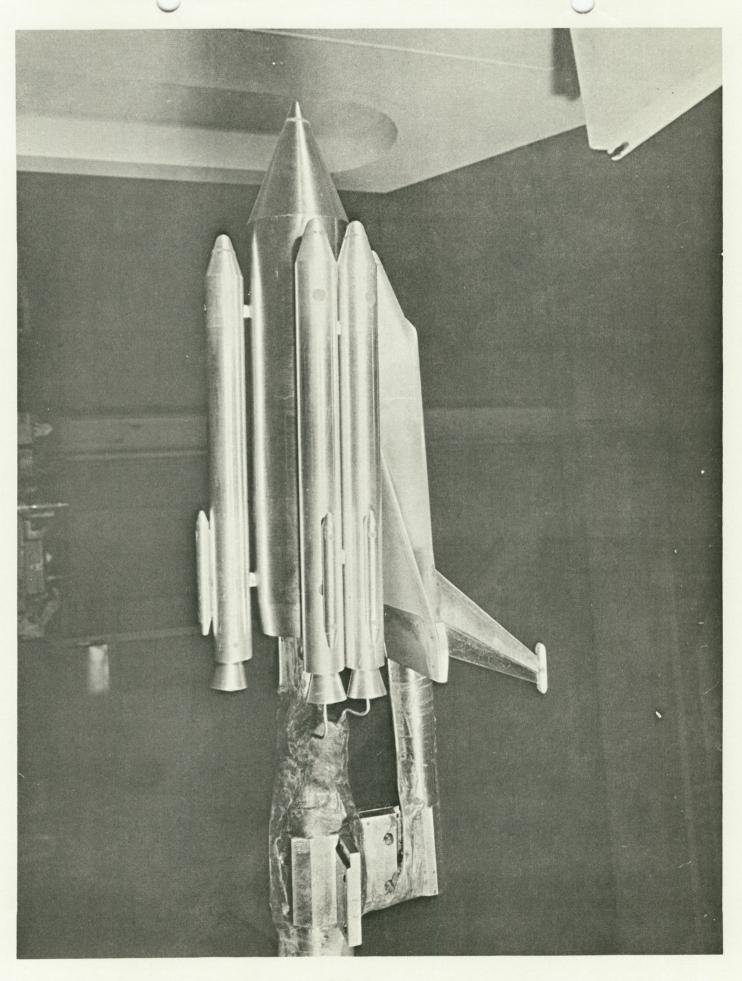
Notes:

- Positive directions of force coefficients moment coefficients, and angles are indicated by arrows.
- 2. For clarity, origins of wind and stability axes have been displaced from the center of gravity.



moment coefficients, angle of attack, and sideslip angle Axis systems, showing direction and sense of force and Figire





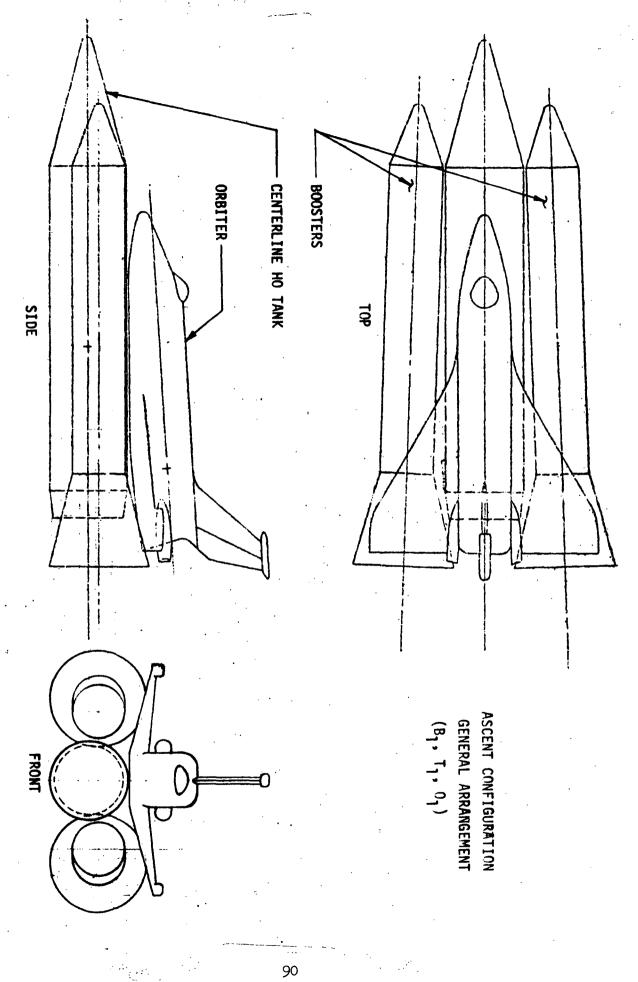
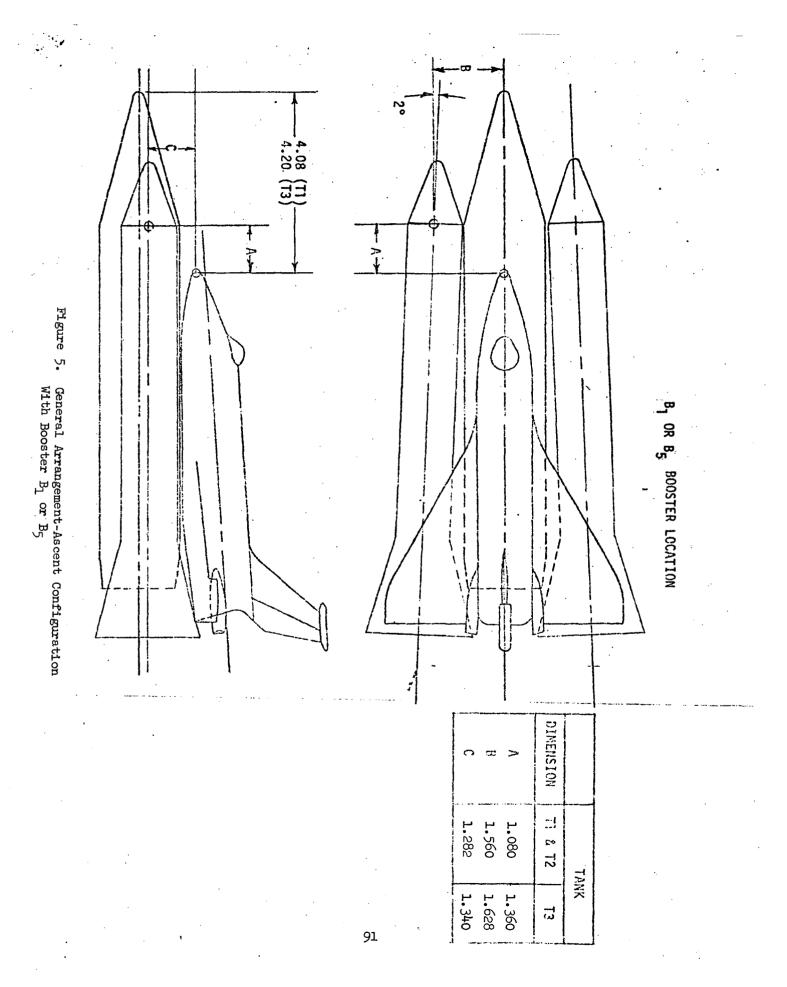
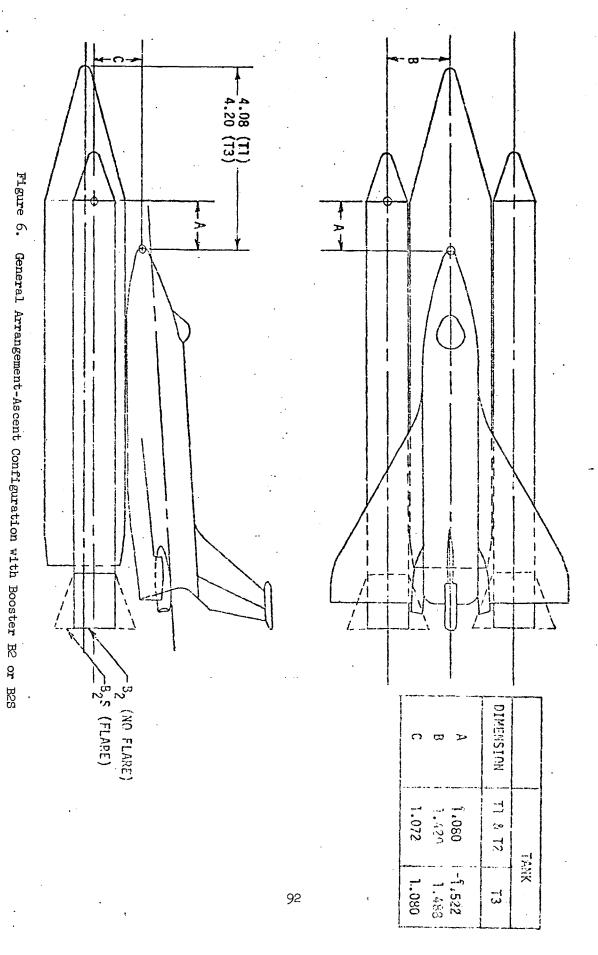
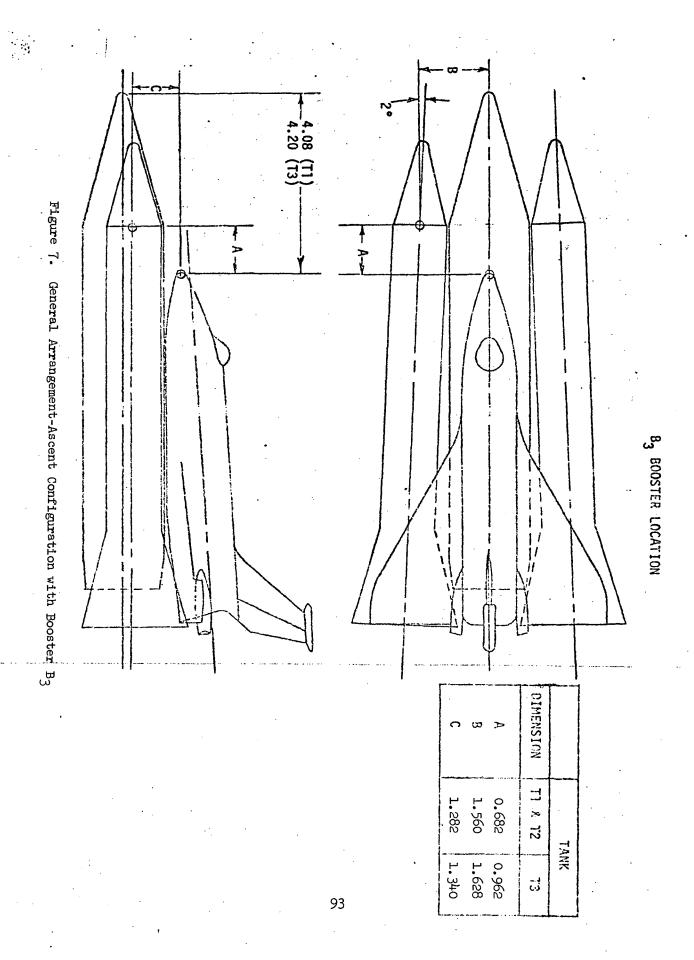


Figure 4. General Arrangement-Ascent Configuration OlTlB1









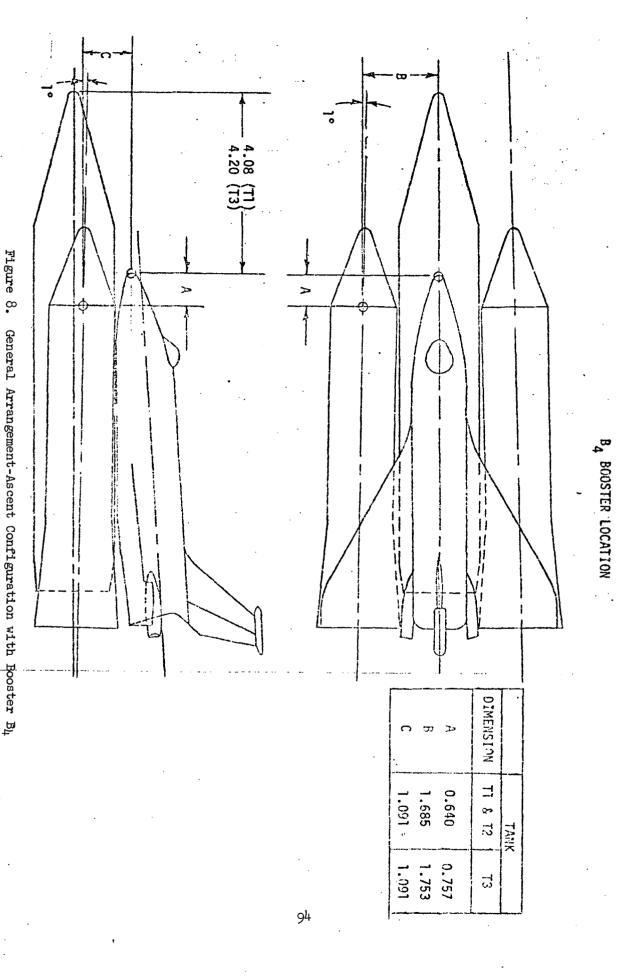
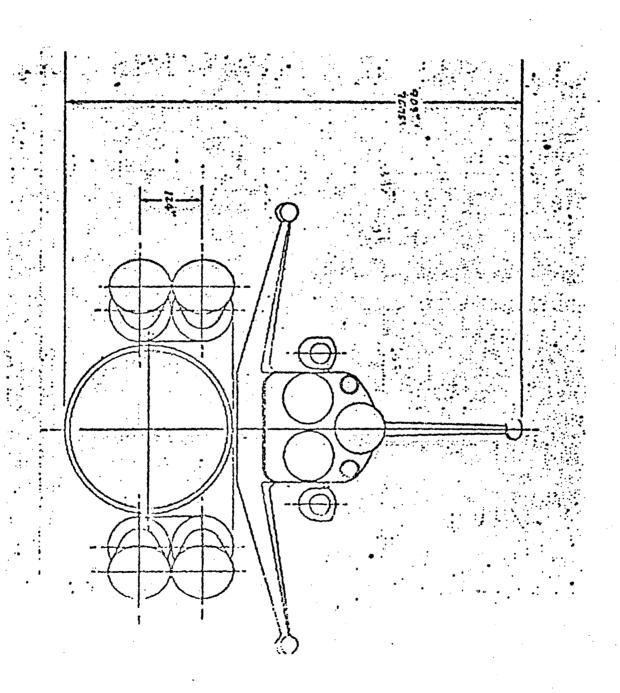


Figure 9. General Arrangement-Ascent Configuration OlT4B7-4 (Side View)

Figure 10. General Arrangement-Ascent Configuration OlT4B7-4 (Top View)



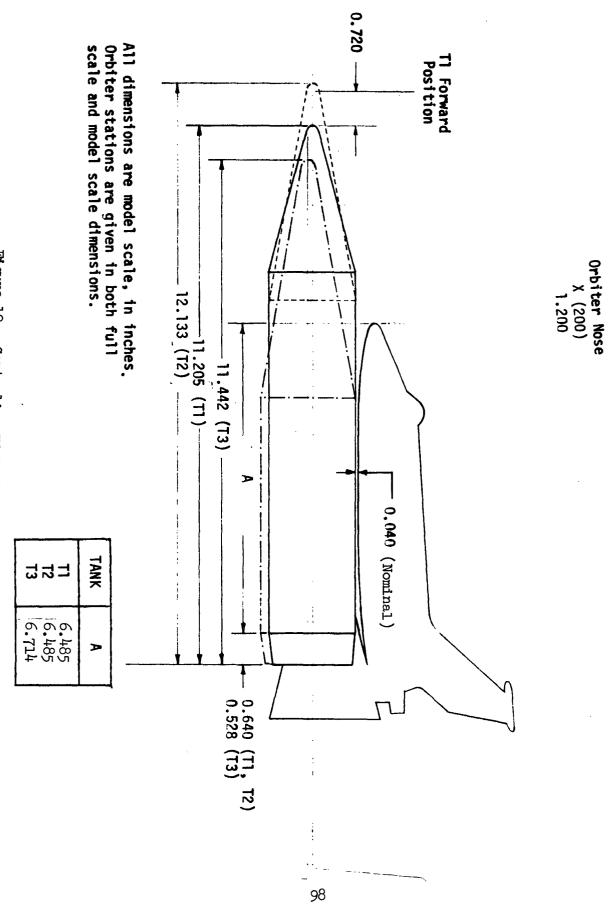


Figure 12. Centerline HO Tank Locations

MOMENT TRANSFER DIAGRAM ASCENT CONFIGURATION

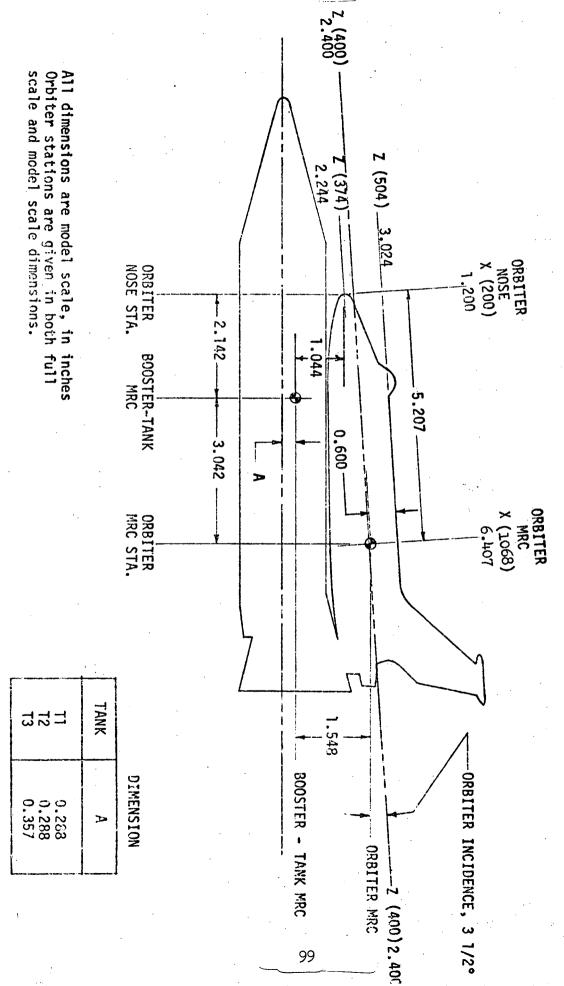
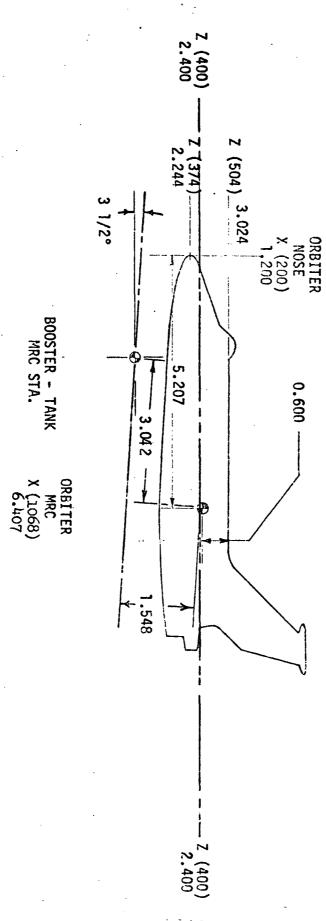


Figure 13. Moment Transfer Diagram for Ascent Configuration

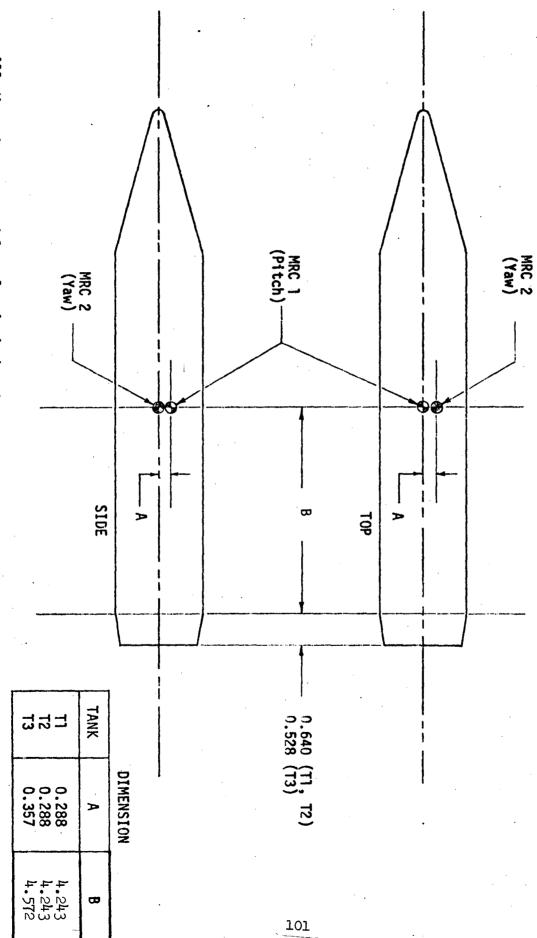
MOMENT TRANSFER DIAGRAM ORBITER ALONE



All dimensions are model scale, in inches
Orbiter stations are given in both full
scale and model scale dimensions.

Figure 14. Moment Transfer Diagram for Orbiter Alone

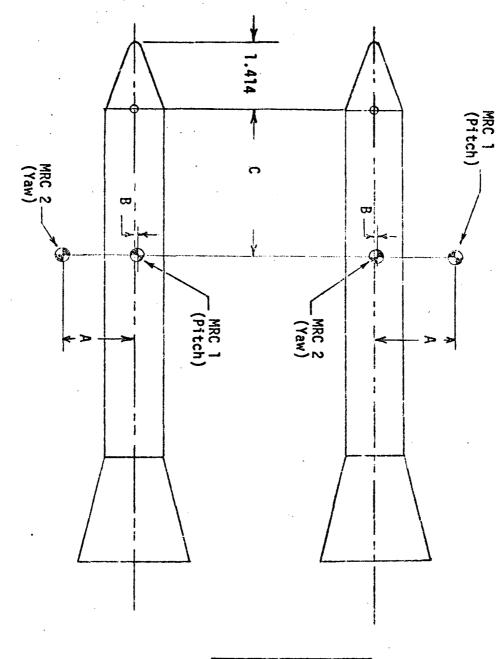
MOMENT TRANSFER DIAGRAM CENTERLINE TANK ALONE



All dimensions are model scale, in inches

Figure 15. Moment Transfer Diagram for Centerline Tank Alone

MOMENT TRANSFER DIAGRAM B₁ Booster Alone



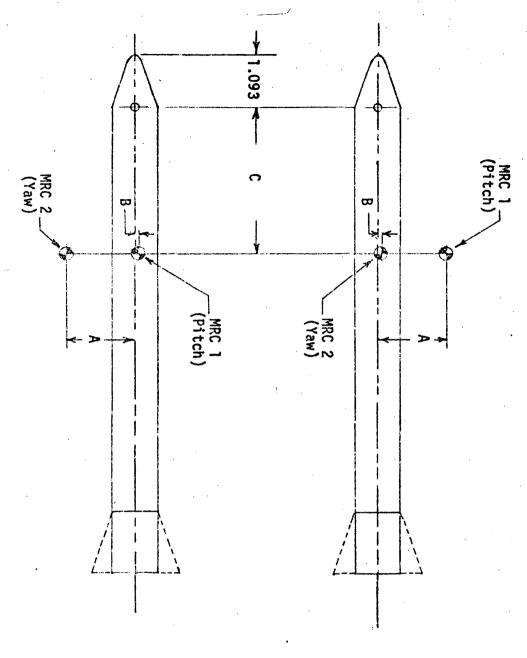
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Figure 16. Moment Transfer Diagram for Bl Booster Alone

		Dimension	
ANK	A	В	0
	1.664	0.238	3.222
Z ₁	1.564	0.238	3.222
ω ^T	1.732	0.297	3.502

= 4.386" From nose

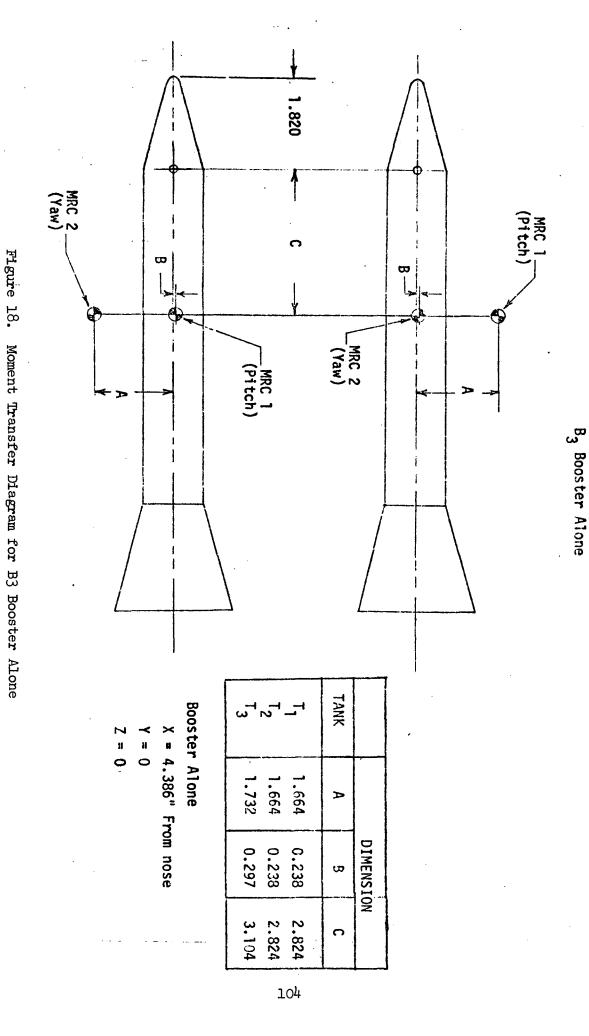
MOMENT TRANSFER DIAGRAM B₂ and B₂S Boosters Alone



A 1.420 1.420 1.488	A	· · · · · · · · · · · · · · · · · · ·	1.420	
	B C			0.037 3.664

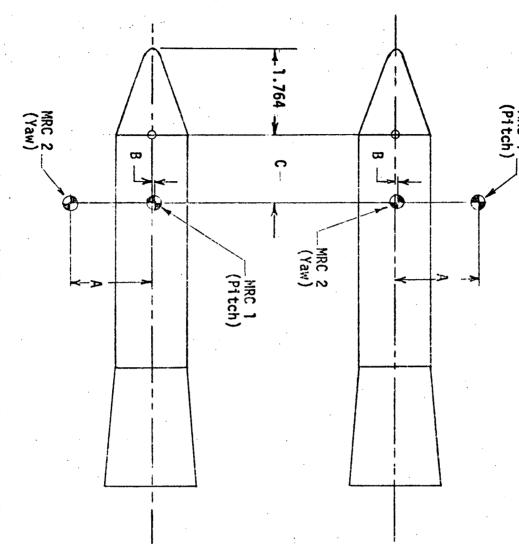
= 4.091" From nose

Figure 17. Moment Transfer Diagram for B2 & B2S Boosters Alone



MOMENT TRANSFER DIAGRAM

MOMENT TRANSFER DIAGRAM B₄ Booster Alone



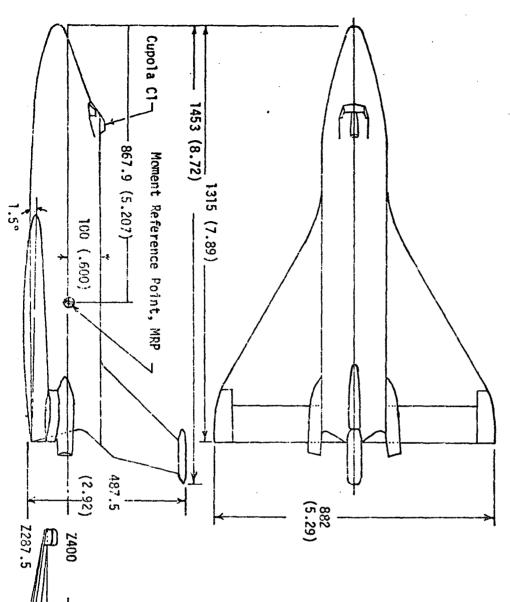
TANK T ₁ T ₂ T ₃	A 1.709 1.709 1.774	0.047 : 0.047 : 0.047	C 1.502 1.502
		1	
TANK	А	ଘ	C
1 ₁	1.709	0.047	1.50
~	1.709	0.047	1.50
ယ ်း	1.774	0.047	1.38

Booster Alone

X = 3.152" From nose

, . ,

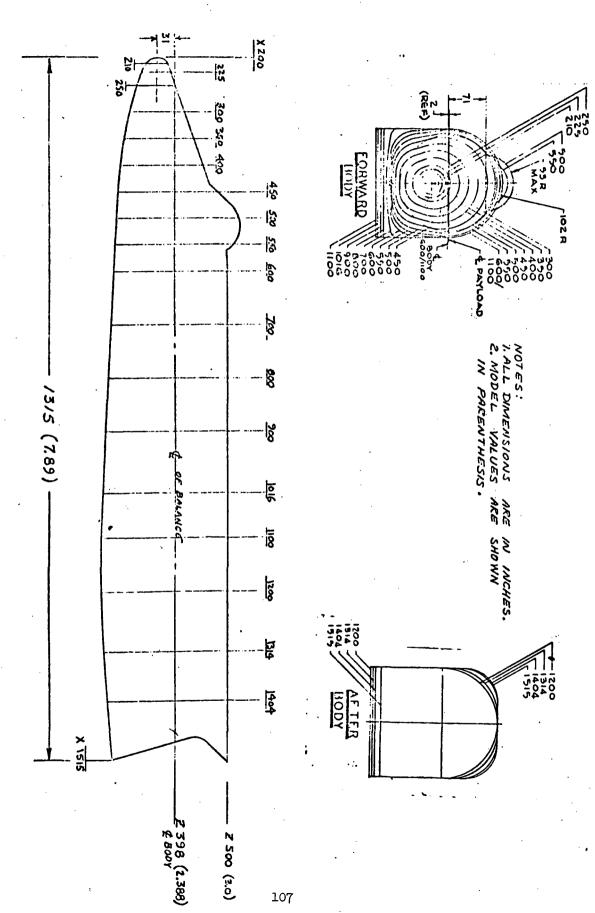
Figure 19. Moment Transfer Diagram for B4 Booster Alone



Notes:

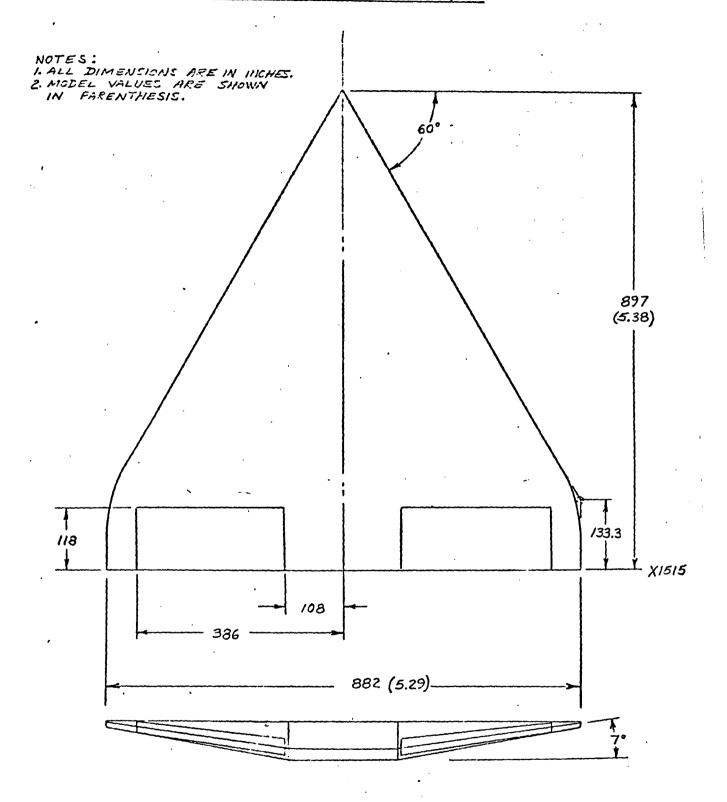
- All dimensions are in inches
- . Model values are shown in parentheses.

Figure 20. General Arrangement 040A Orbiter



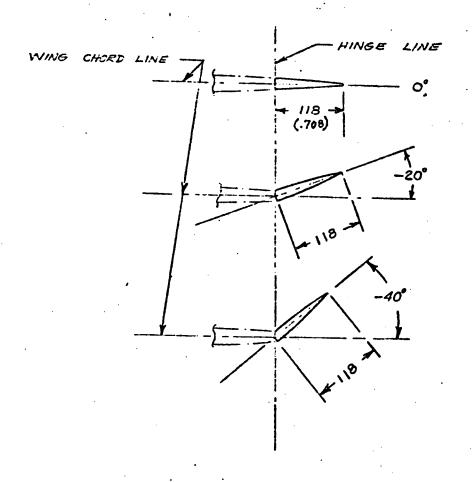
107

Figure 21. Orbiter Body, B₁

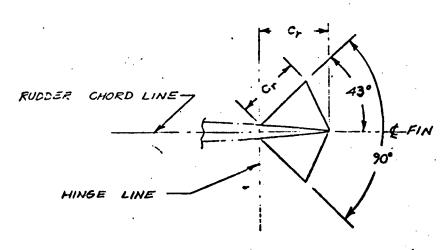


. Figure 22. Wing and Elevon, W_{1}

ELEVON DEFLECTIONS



RUDDER FLARE AT A TYPICAL SECTION



NOTES:
1. DIMENSIONS ARE IN INCHES
2. Cr IS RUDDER LOCAL
CHORD.
3. MODEL VALUES SHOWN IN PROSPERTIES.

Note: Additional rudder flare angle of ± 17.5° was tested at M= .6,.9,1.2 for lateral-directional data

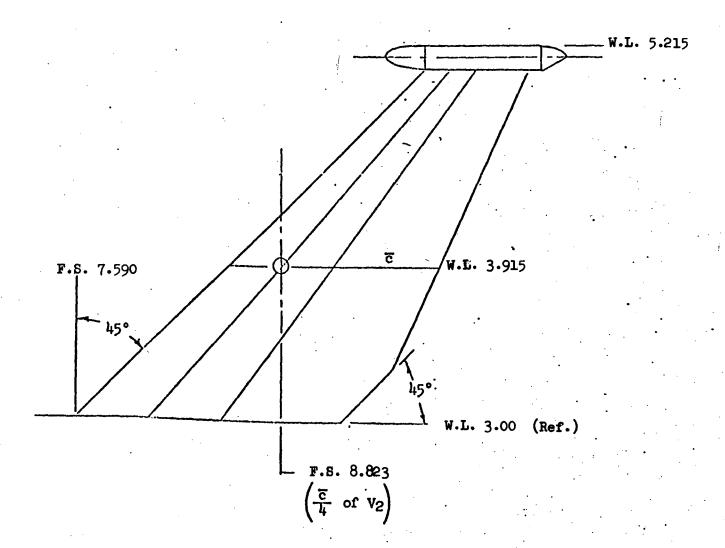
Figure 23. Elevon Deflections and Rudder Flare

NOTES: I. ALL DIMENSIONS ARE IN INCHES. 2. MODEL VALUES ARE SHOWN IN PARENTHESIS. X 1265 - 288 (1.727) -8 15 - 65,9--X 1553 109.7 --183 (1008) ----1 43.8 270 (1.620) 40.5 X500 110

Figure 24. Vertical Fin and Rudder, V1

VO - LARGER AREA CENTERLINE VERTICAL TAIL AND RUDDER

$$S_V = 2.514 \text{ in}^2$$
 $C_R = 1.728 \text{ in}$ $C_T = 0.542 \text{ in}$ $\bar{c} = 1.239 \text{ in}$ $\lambda = 0.310$ $\Lambda_{LE} = 45^\circ$

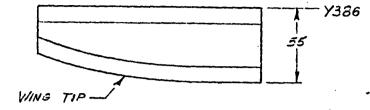


Note: All dimensions are model scale in inches.

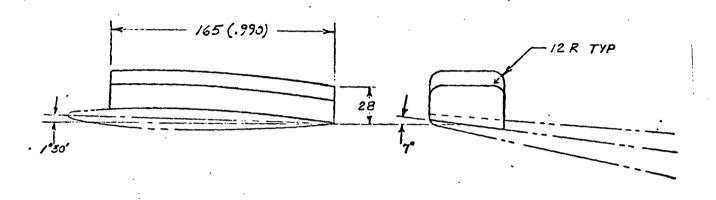
Figure 25. Vertical Fin and Rudder, V_2

MCDONNELL DOUGLAS CORPORATION

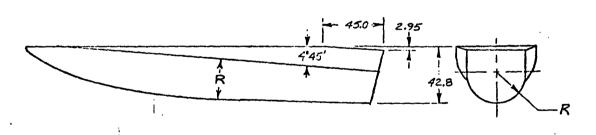
ACPS ENGINE POD ~ PI



NOTES:
1-ALL DIMENSIONS ARE IN
INCHES.
2. MODEL VALUES ARE SHOWN
IN PARENTHESIS.



OMS ENGINE FOD ~ MI



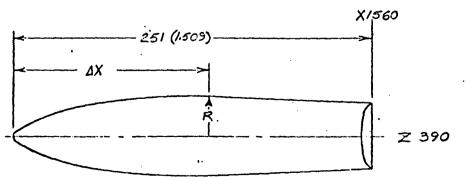


Figure 26.	ACPS Engine Pod, Pl and OMS Engine Pod, Ml	

R 0.5.0 23.7 28.5 29.5 29.0

25.0 58.3 75.0 100.0 133.0 245.0



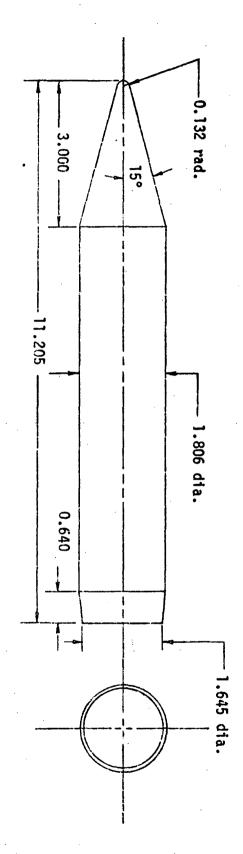


Figure 27. Centerline HO Tank, Tl



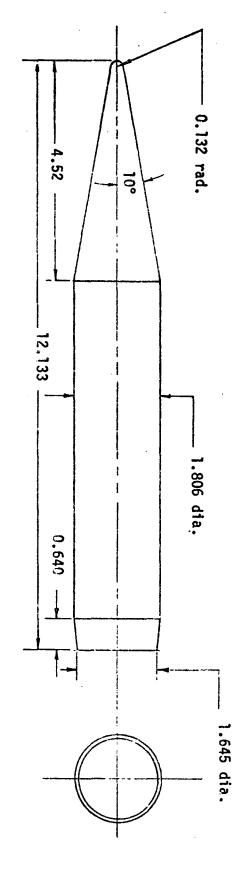


Figure 28. Centerline HO Tank, T2



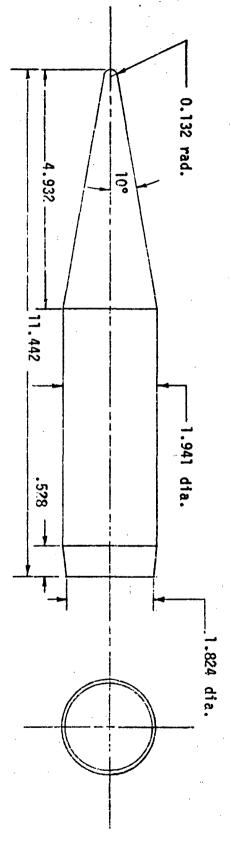
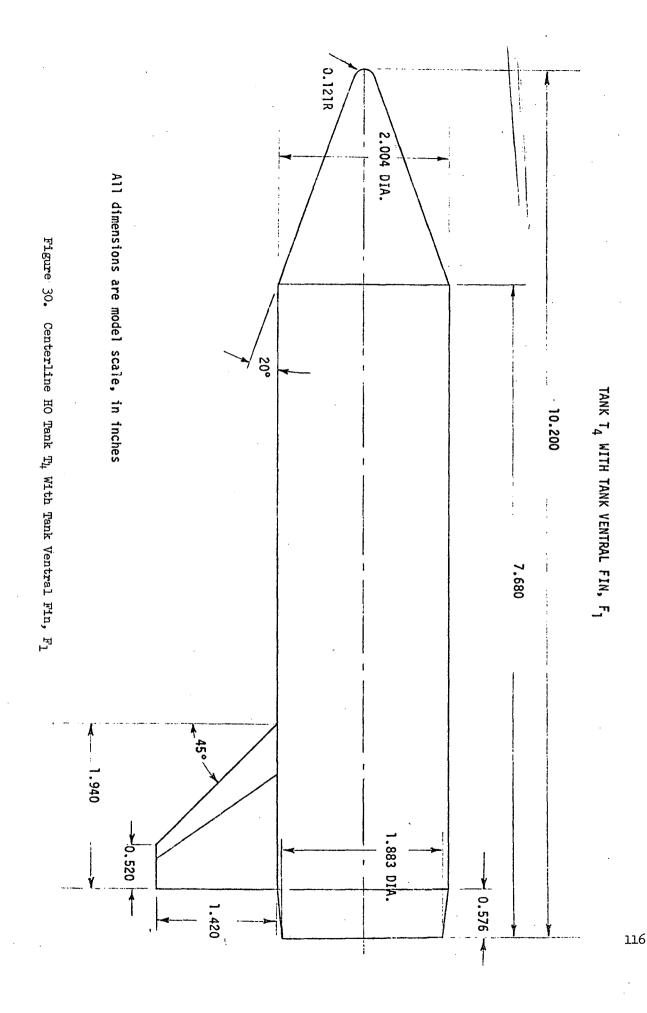
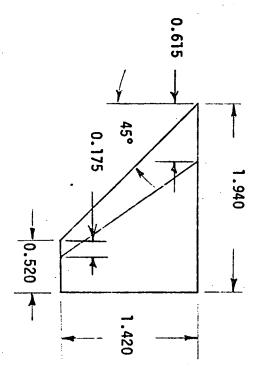


Figure 29. Centerline HO Tank, T3

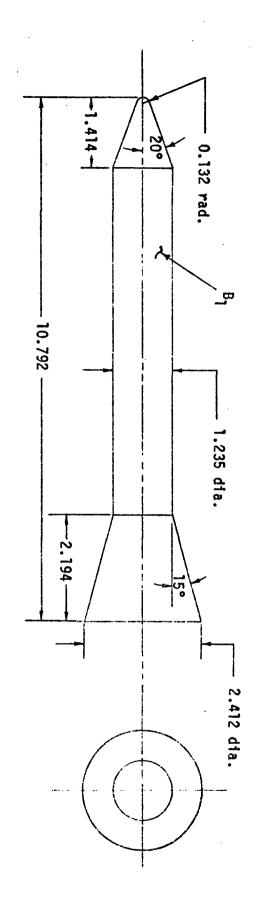


TANK YENTRAL FIN, F1



All dimensions are model scale, in inches

Figure 31. Centerline Ventral Fin, F1

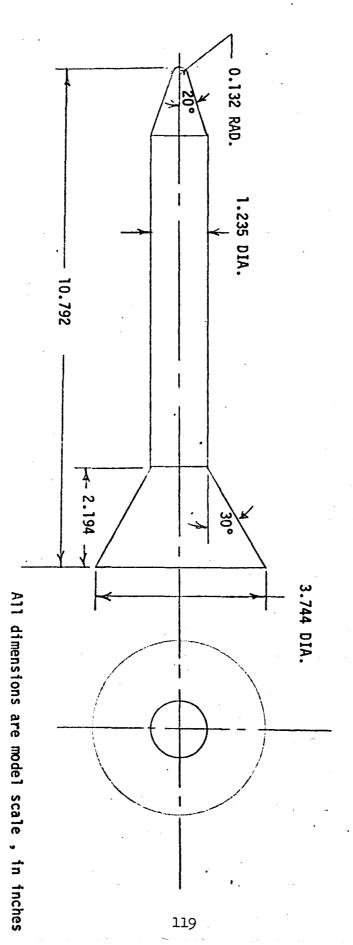


8.85° Ref

1.916 dia.

Figure 32. Boosters, B_1 and B_5

← 2.194 →



B₁S₁

Figure 33. Booster, B₁S₁

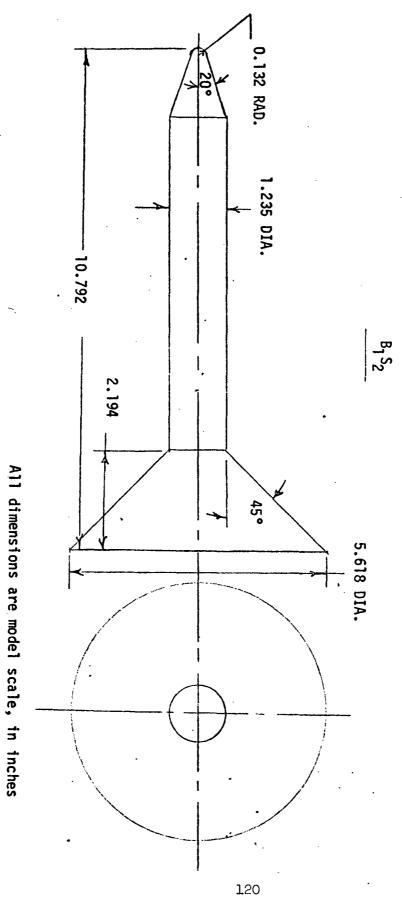


Figure 34. Booster, B₁S₂

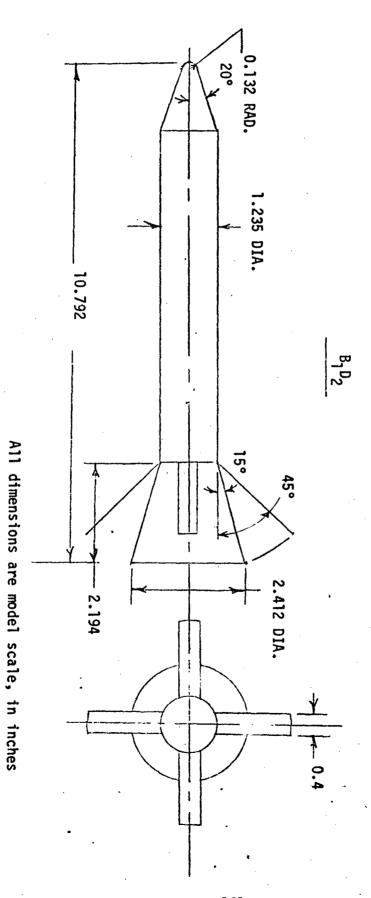


Figure 35. Booster, B₁D₂

Figure 35. (Continued)

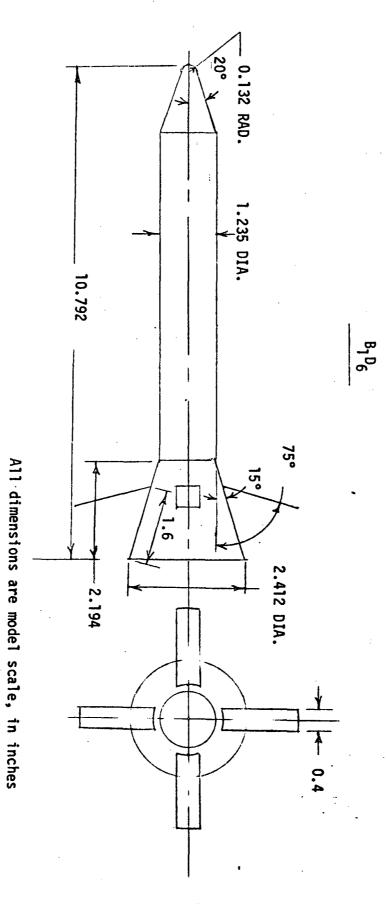


Figure 36. Booster, B₁D₆

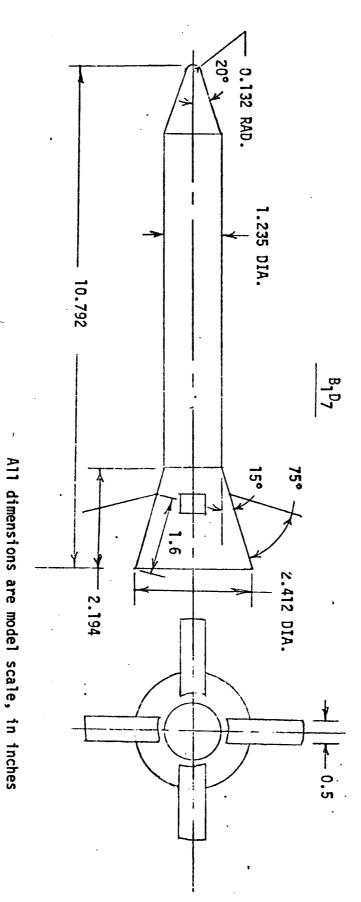


Figure 37. Booster, BlD7

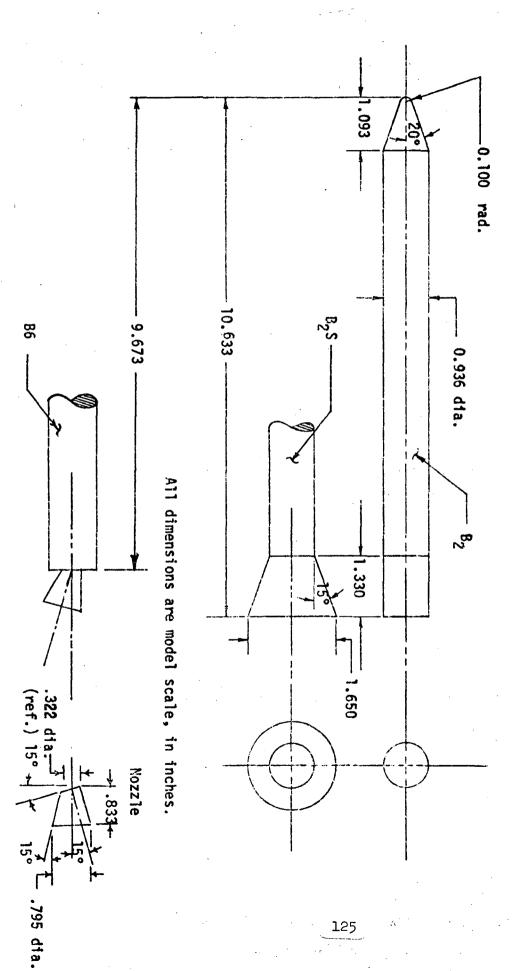
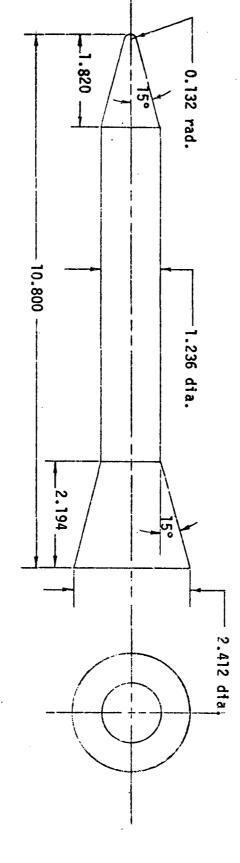


Figure 38. Boosters, B2, B28 & B6

125





All dimensions are model scale, in inches.

Figure 39. Booster, B3

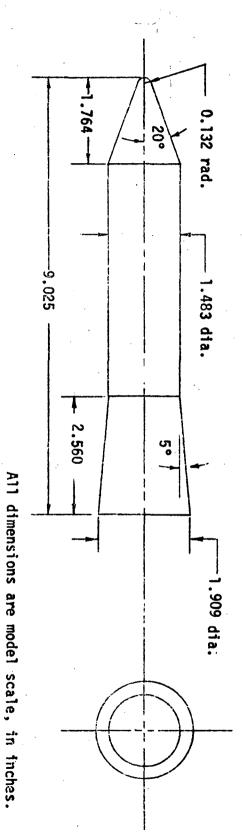
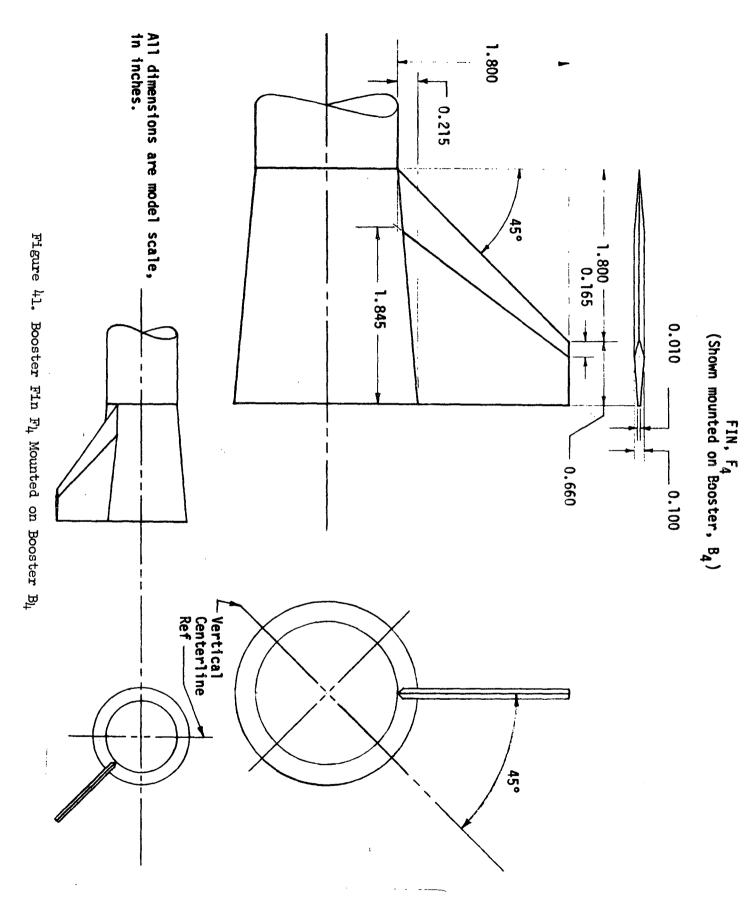


Figure 40. Booster, B4



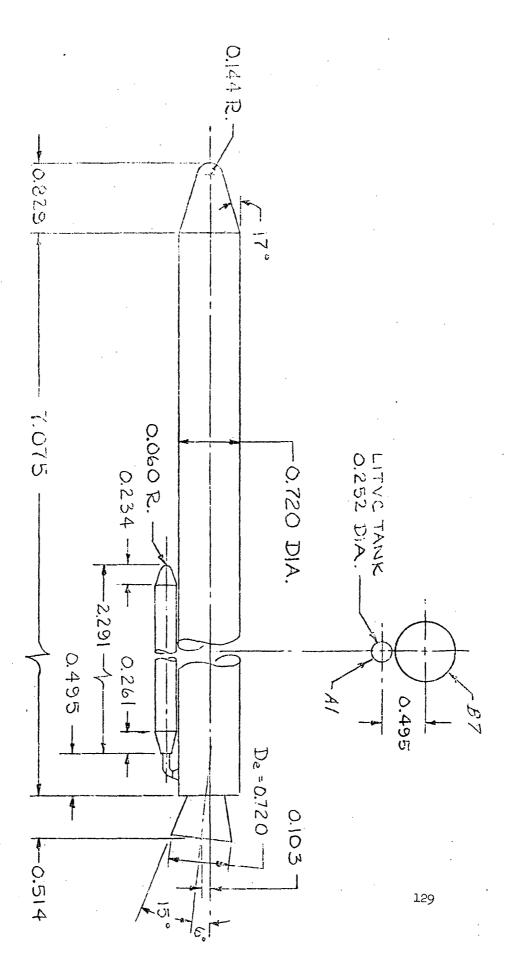


Figure 42. Booster, B7A1

MALE FULL KNATTAKUS 1-15-12

TRMOINOTO

0.6% SCALE MODEL

FORM 25-BP (P5V, 8-60) CHECKED BY: ______ DIVISION MODEL: _________DIVISION

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Figure 43. Plume Contours for Pressure Fed Boosters

KOE ALBANKNE® LA 3251

FORM 25.8P

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY

CHECKED BY:

DATE:

DIVISION

REPORT NO:

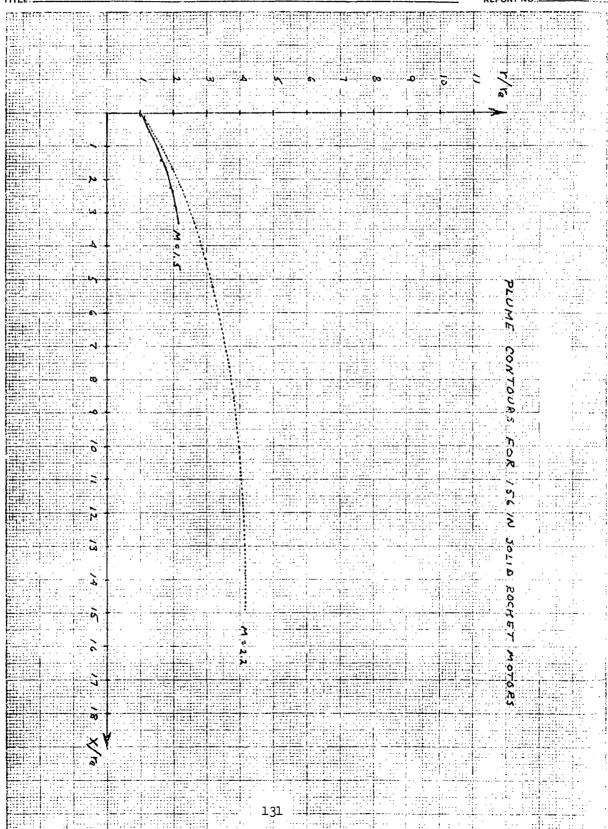


Figure 44. Plume Contours for 156 Inch Solid Rocket Motors

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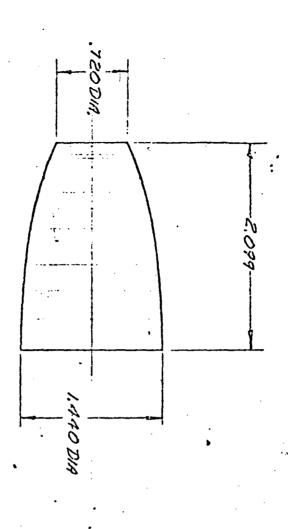
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Figure 45. Plume Contour for Orbiter

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Figure 46. Sketch of Plume for Booster B_7

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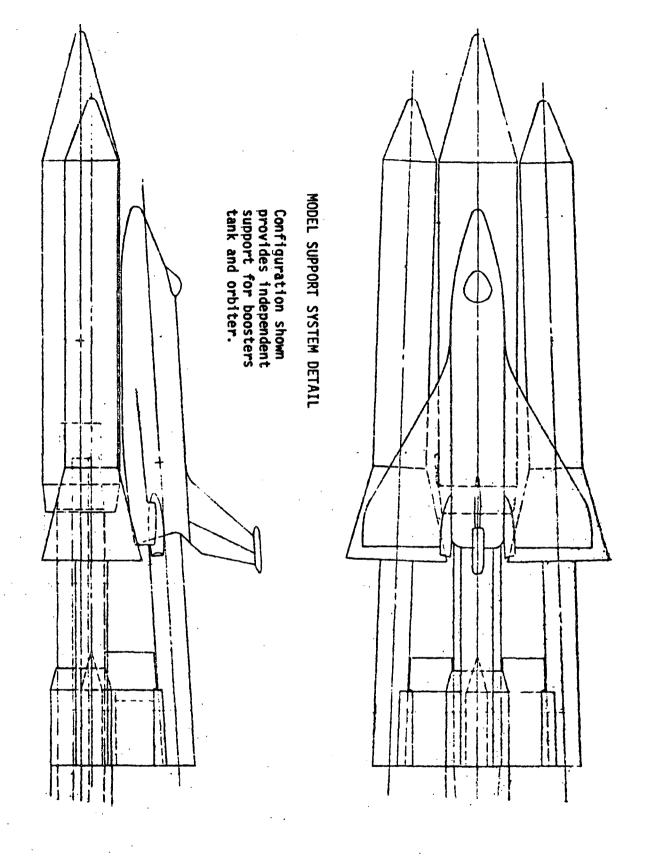


Figure 47. Tunnel Installation for the OBT Configuration-Pitch Series (Orbiter, Tank and Booster Independently Supported)

TUNNEL INSTALLATION FOR THE OBT CONFIGURATION PITCH SERIES

Boosters and Orbiter fixed to centerline tank.

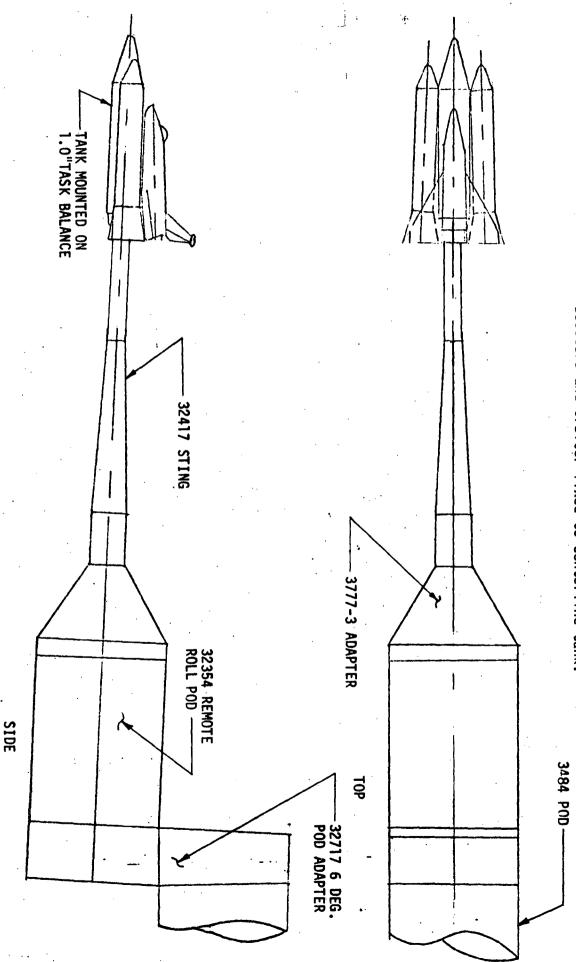


Figure 48. Tunnel Installation for the OBT Configuration-Pitch Series (Booster and Orbiter Fixed to Centerline Tank)

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TUNNEL INSTALLATION FOR THE OBT CONFIGURATION PITCH SERIES ROSsters fixed to contenting tent

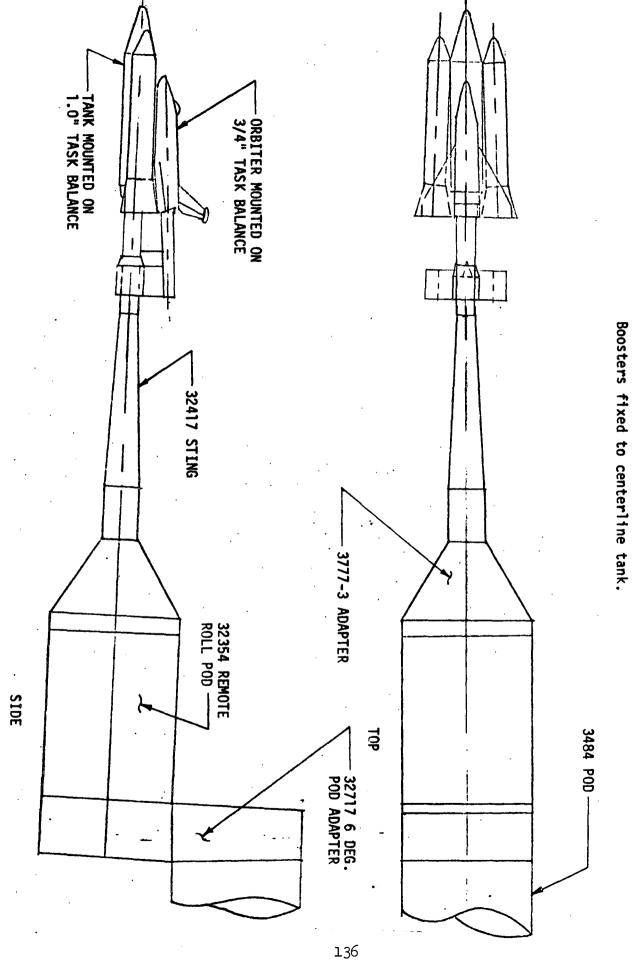


Figure 49. Tunnel Installation for the OBT Configuration-Pitch Series (Booster Fixed to Centerline Tank)

ORBITER MOUNTED ON 3/4" TASK BALANCE TANK MOUNTED ON 1.0" TASK BALANCE TUNNEL INSTALLATION FOR THE OBT CONFIGURATION PITCH SERIES Right Booster fixed to centerline tank, left Booster Independently supported. - 32417 STING -3777-3 ADAPTER ROLL POD ____ **7**9 3484 POD--32717 6 DEG. POD ADAPTER

Figure 50. Tunnel Installation for the OBT Configuration-Pitch Series (Right Booster Fixed to Centerline Tank, Left Booster Independently Supported)

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TUNNEL INSTALLATION FOR THE OBT CONFIGURATION PITCH SERIES

Left and Right boosters independently supported with centerline tank, Tl in forward position. 3484 POD-

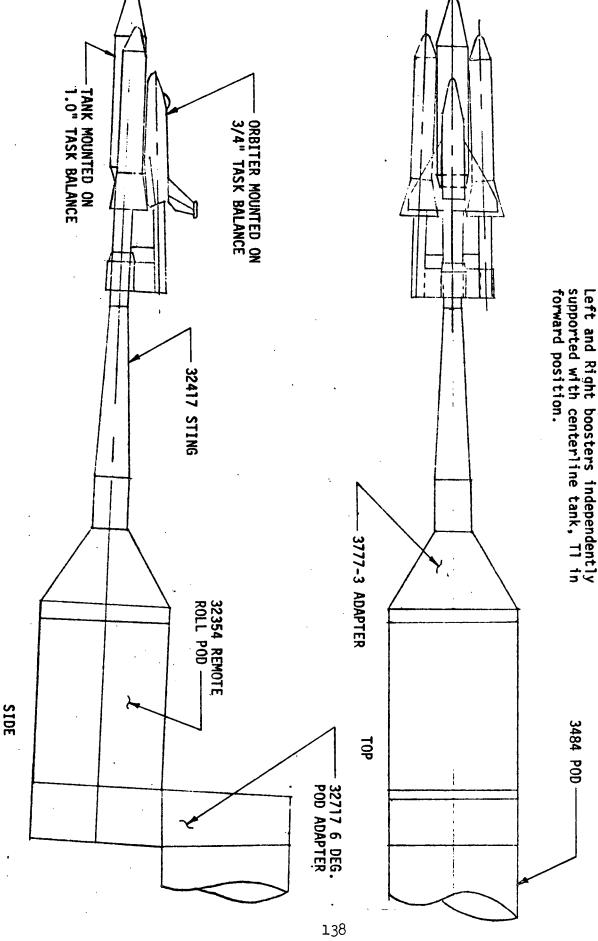
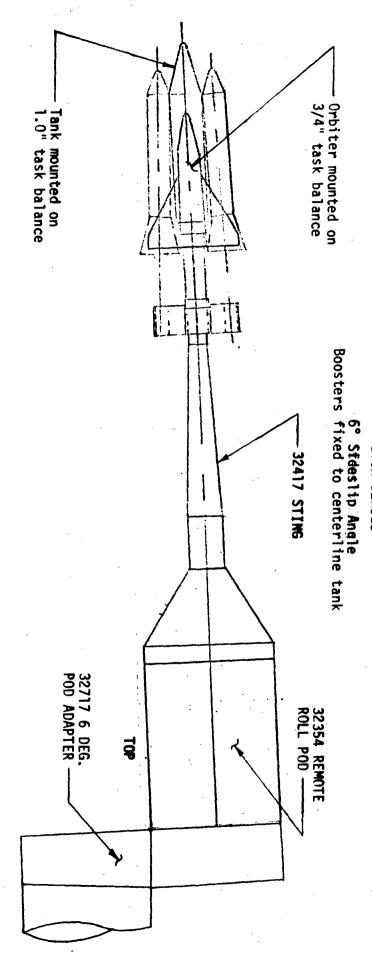


Figure 51. Tunnel Installation for the OBT Configuration-Pitch Series (Left and Right Booster Independently Supported)

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TUNNEL INSTALLATION FOR THE OBT CONFIGURATION PITCH SERIES



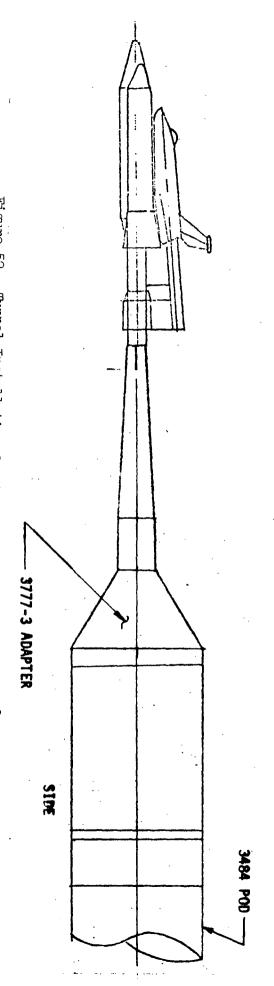
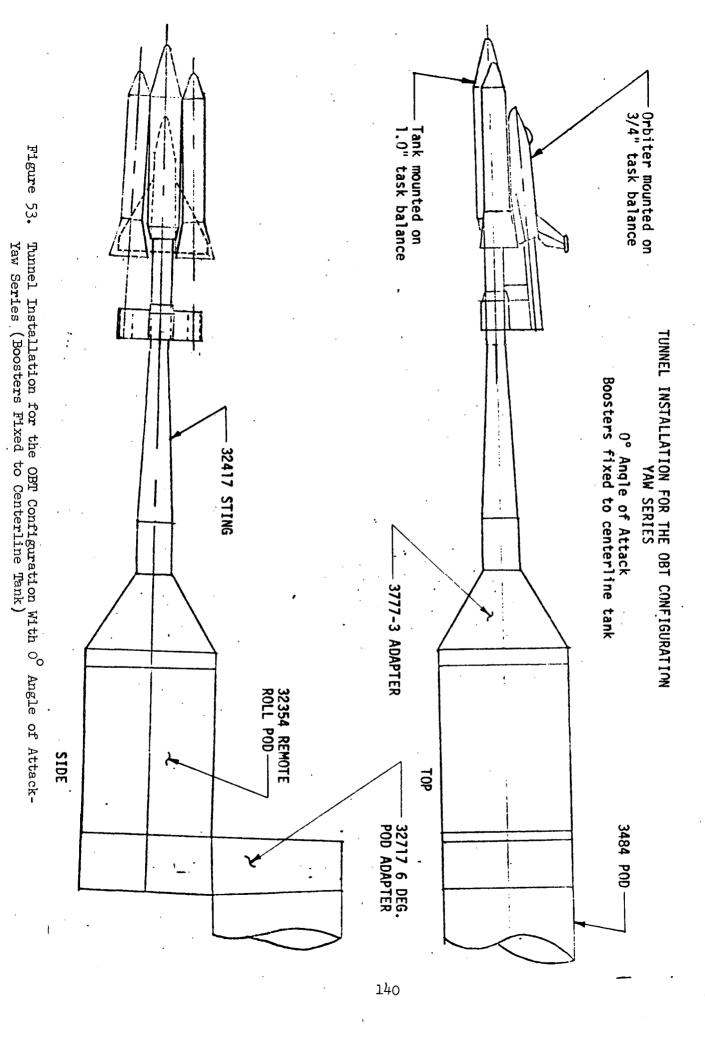
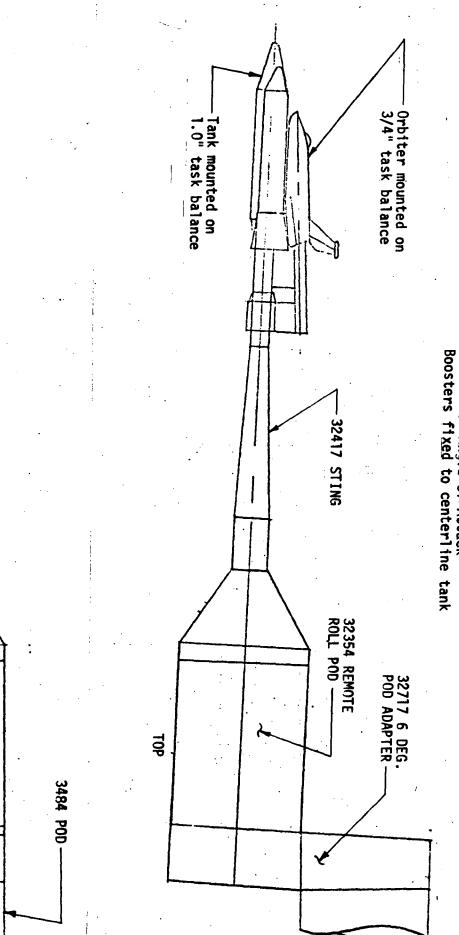


Figure 52. Tunnel Installation for the OBT Configuration With $6^{\rm O}$ Sideslip Angle-Pitch Series (Boosters Fixed to Centerline Tank)



TUNNEL INSTALLATION FOR THE OBT CONFIGURATION YAW SERIES

6° Angle of Attack



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Figure 54. Tunnel Installation for the OBT Configuration With 6° Angle of Attack-Yaw Series (Boosters Fixed to the Centerline Tank)

- 3777-3 ADAPTER

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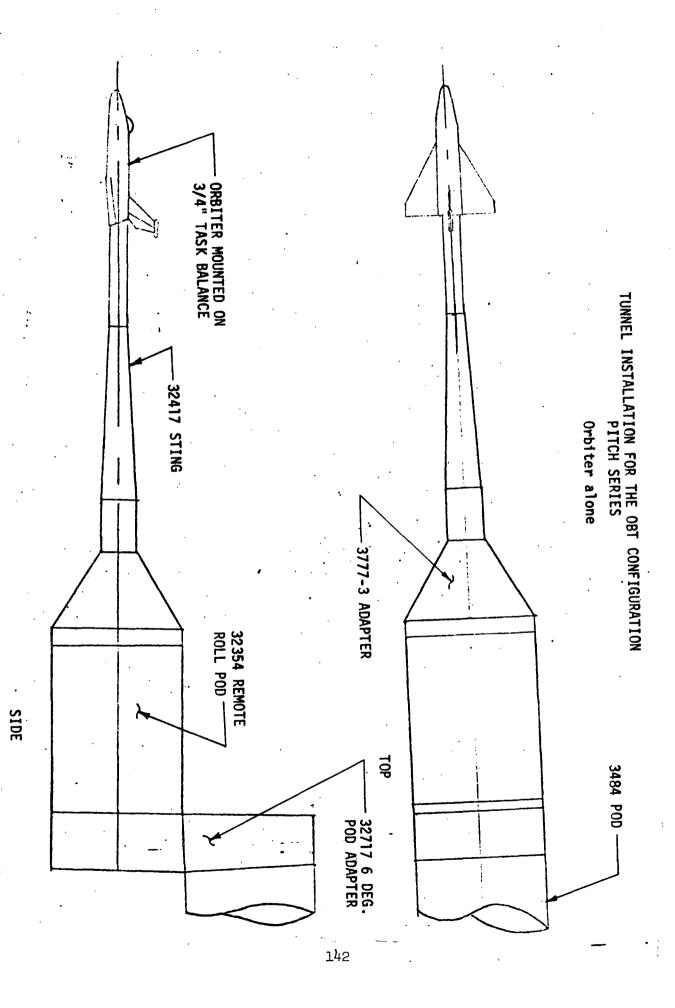


Figure 55. Tunnel Installation for the Orbiter Alone Configuration

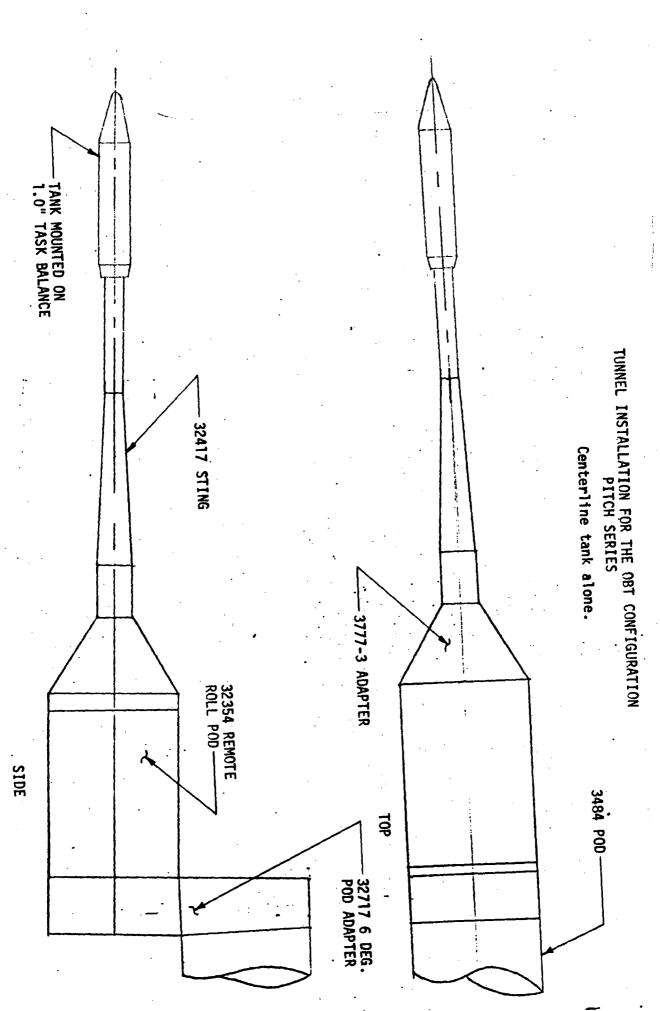


Figure 56. Tunnel Installation for the Tank Alone Configuration

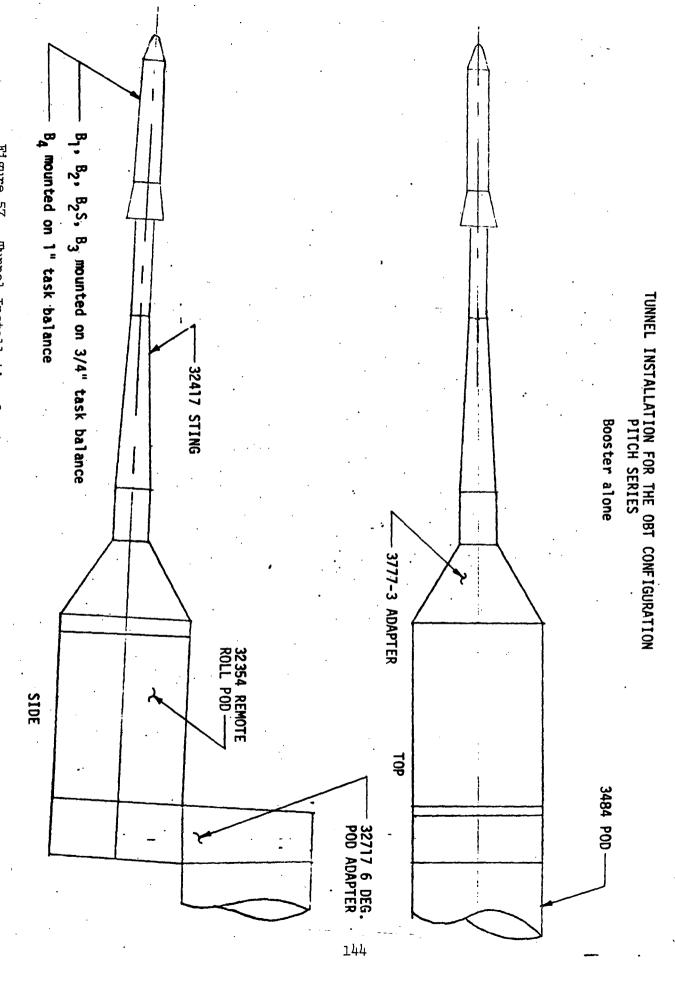
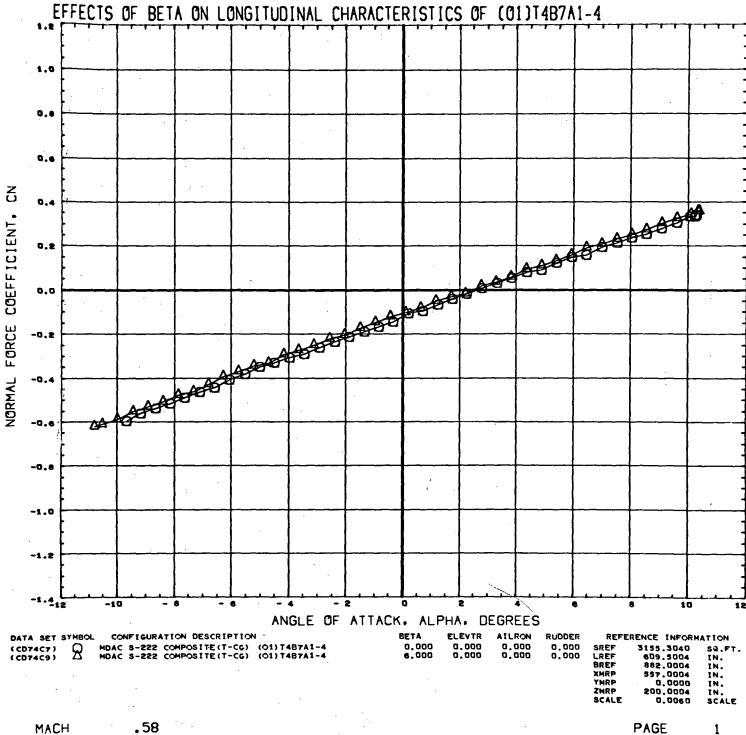


Figure 57. Tunnel Installation for the Booster Alone Configuration

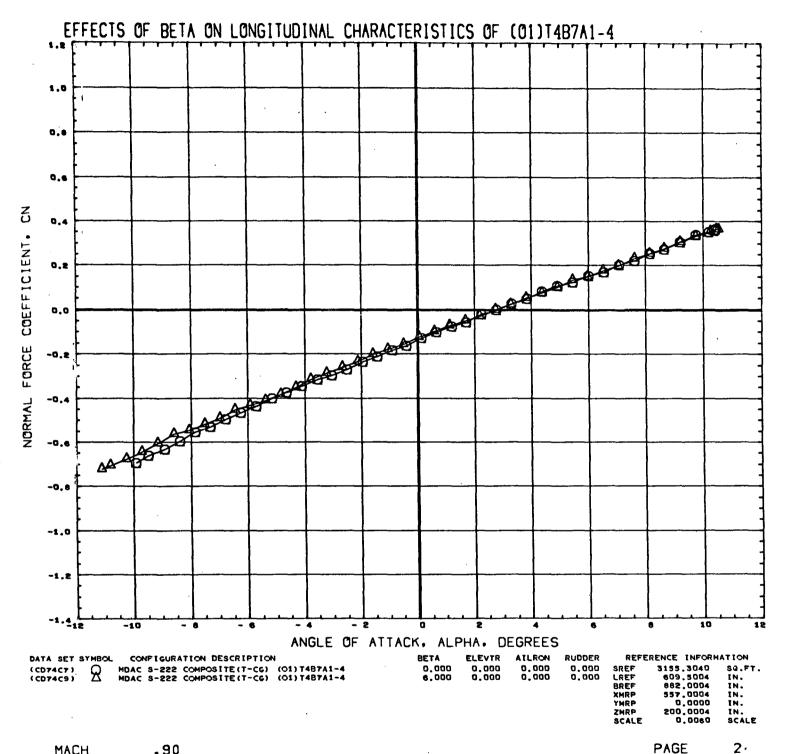
DATA FIGURES

Tabulations of the plotted data and corresponding source data are available from SADSAC Operations.

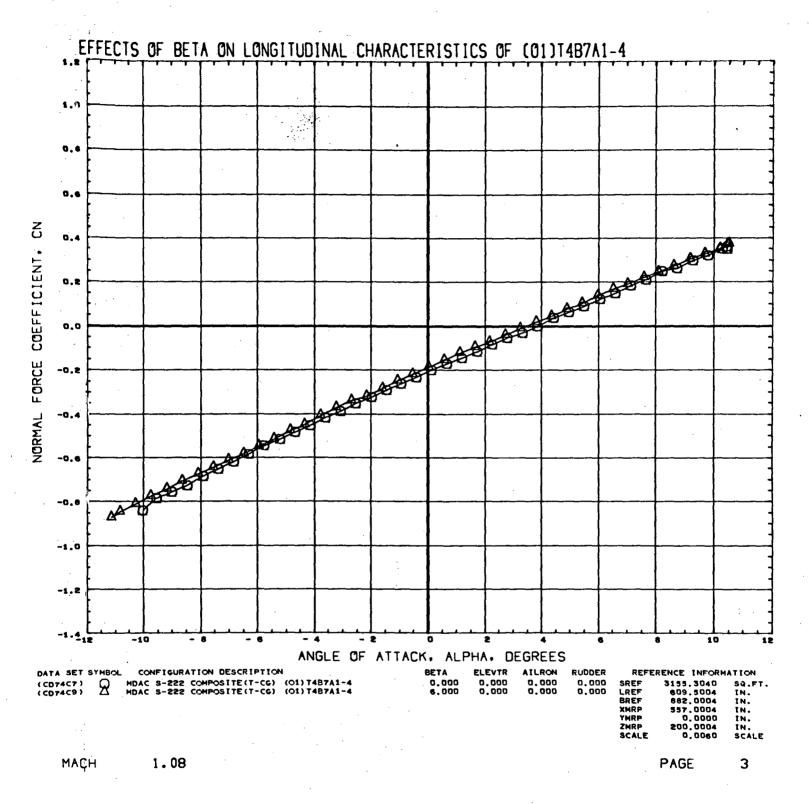


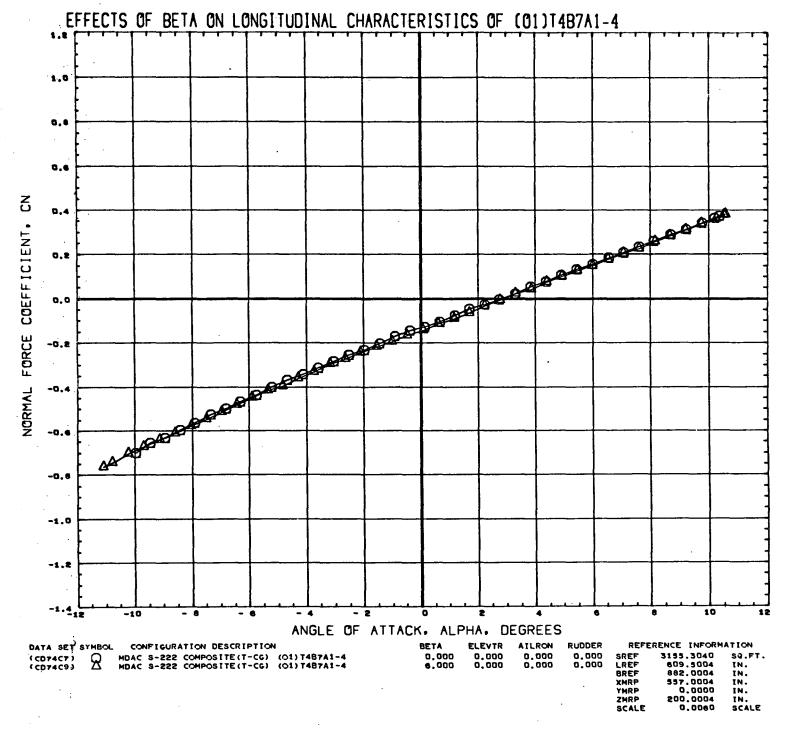
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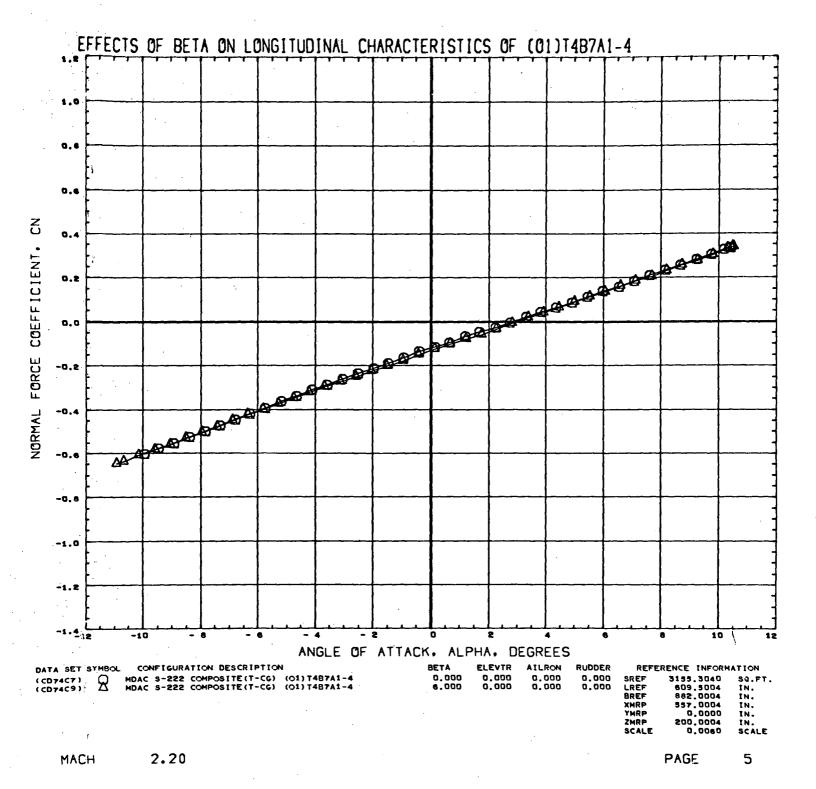
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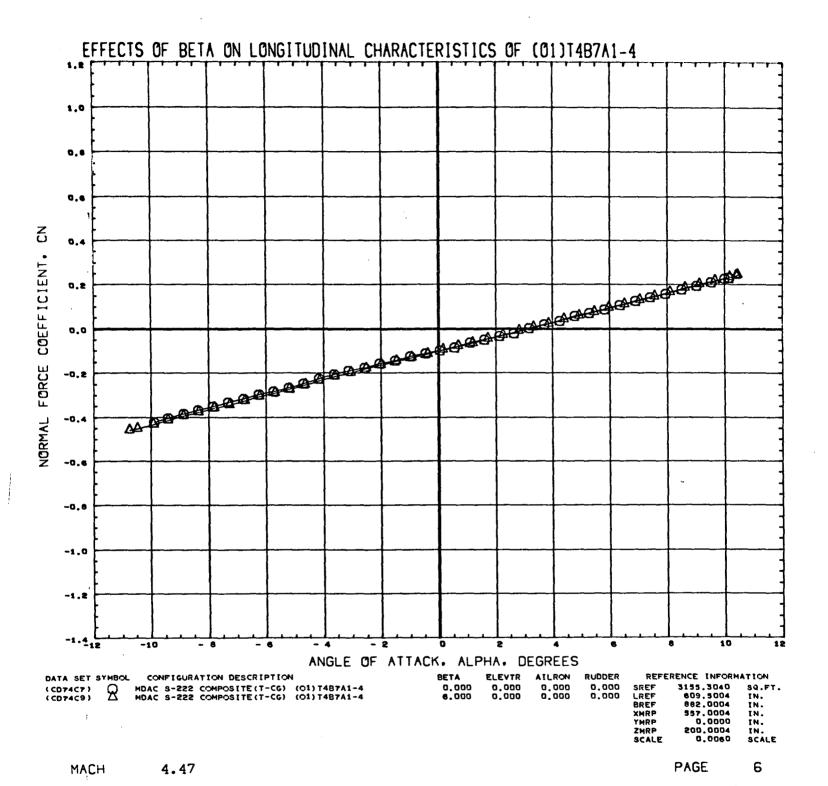


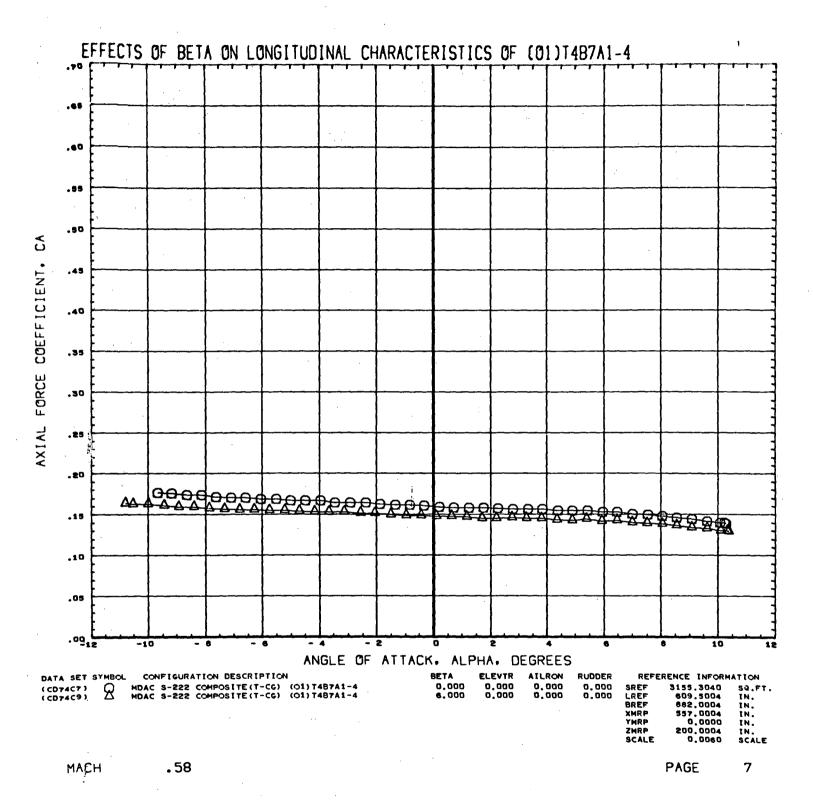


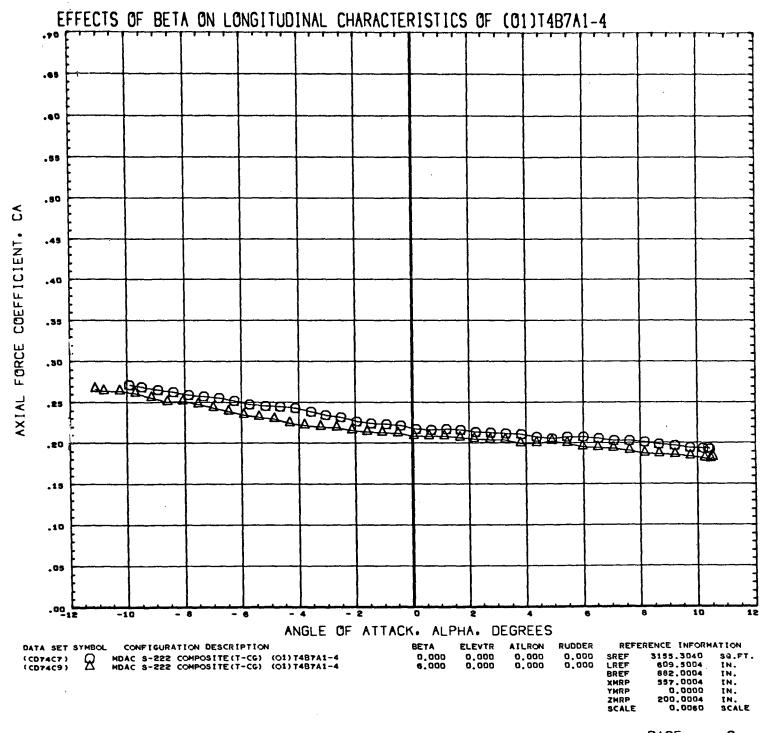
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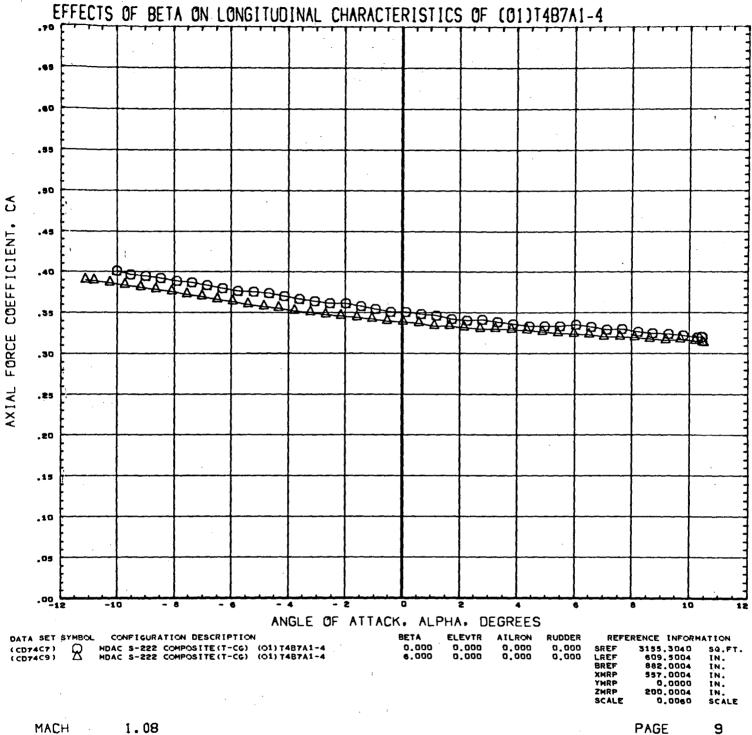
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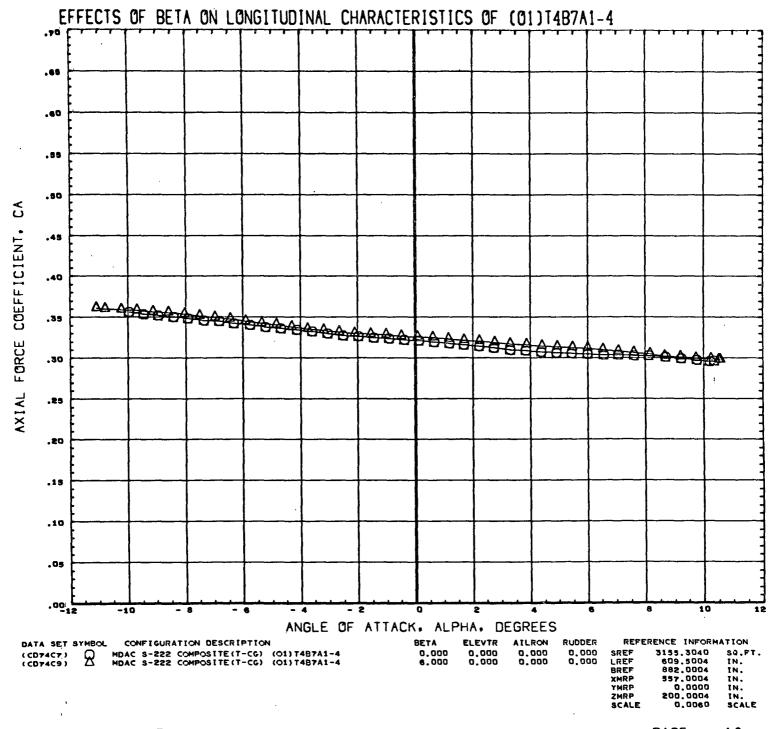




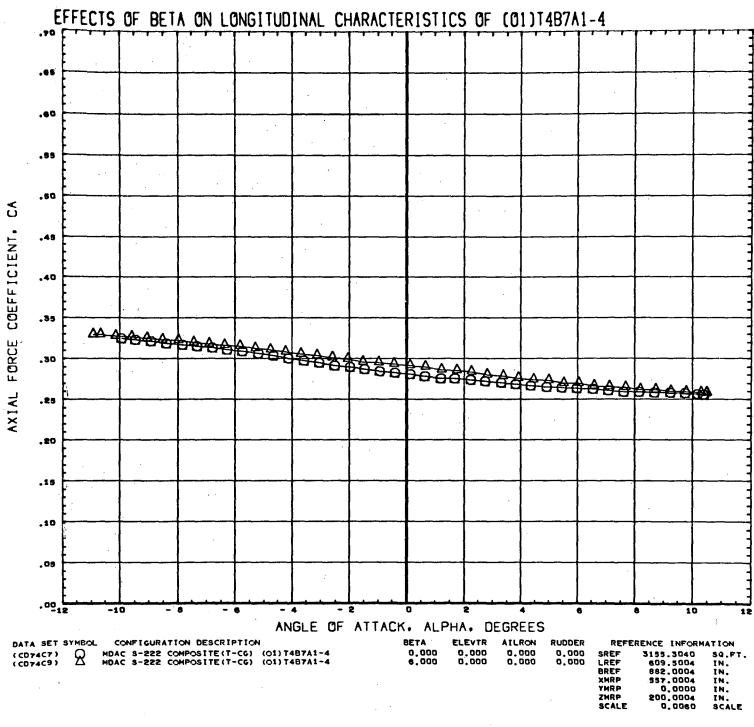




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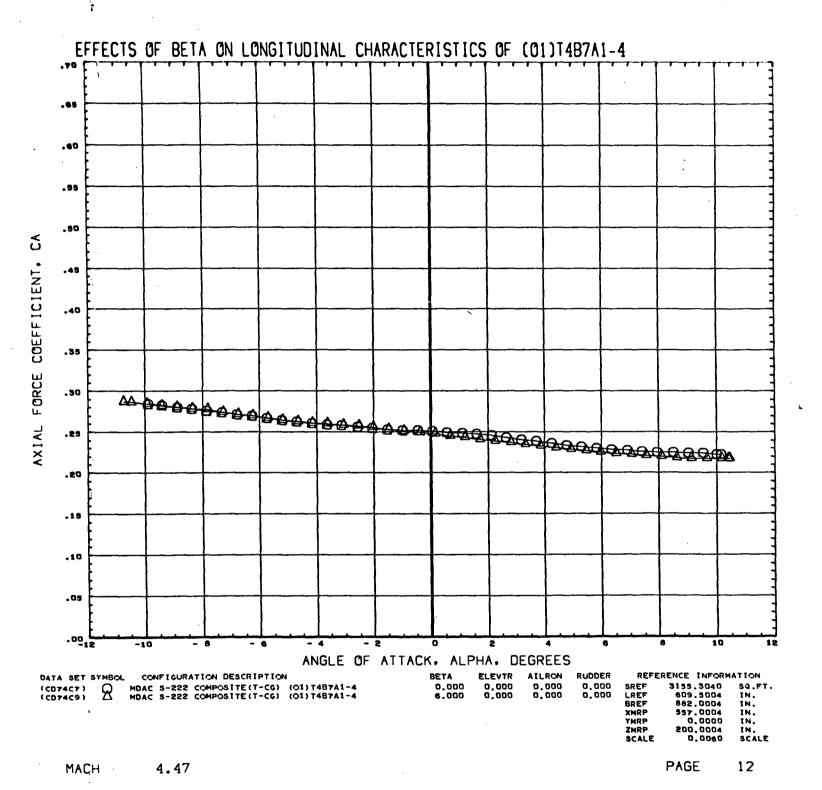


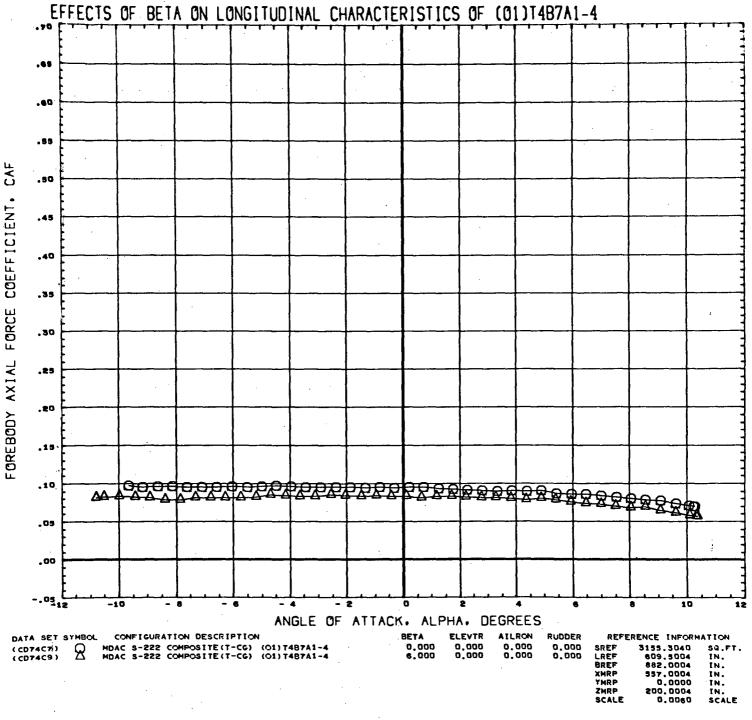
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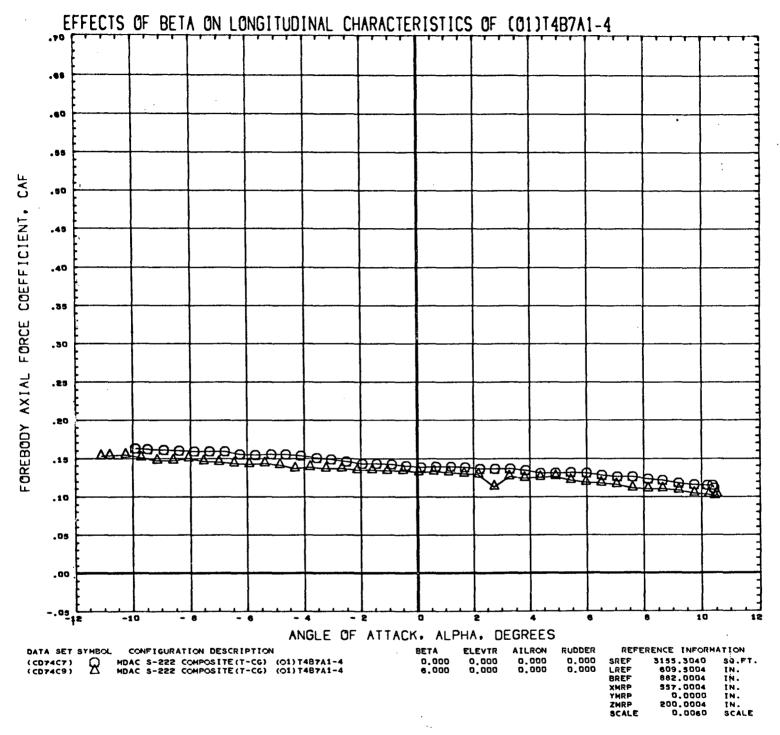
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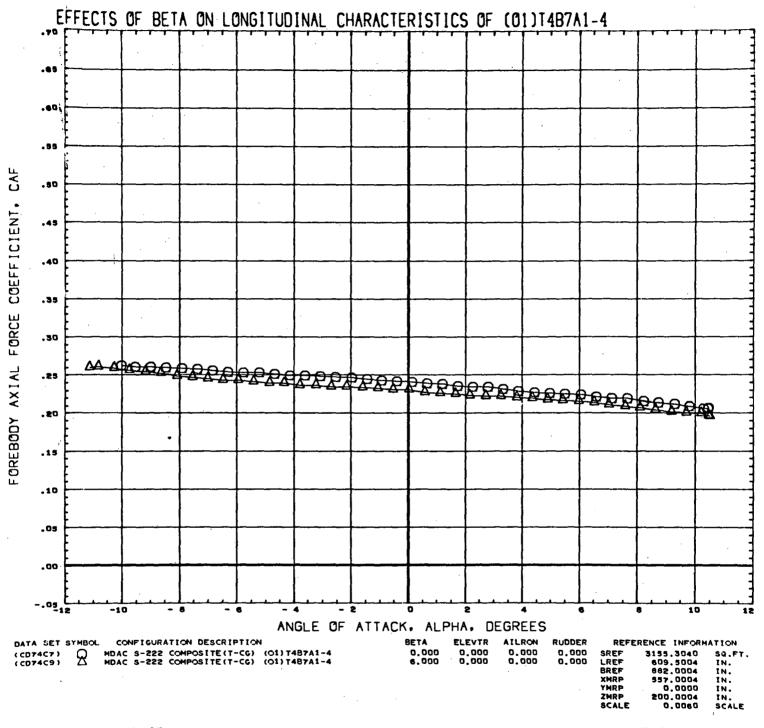




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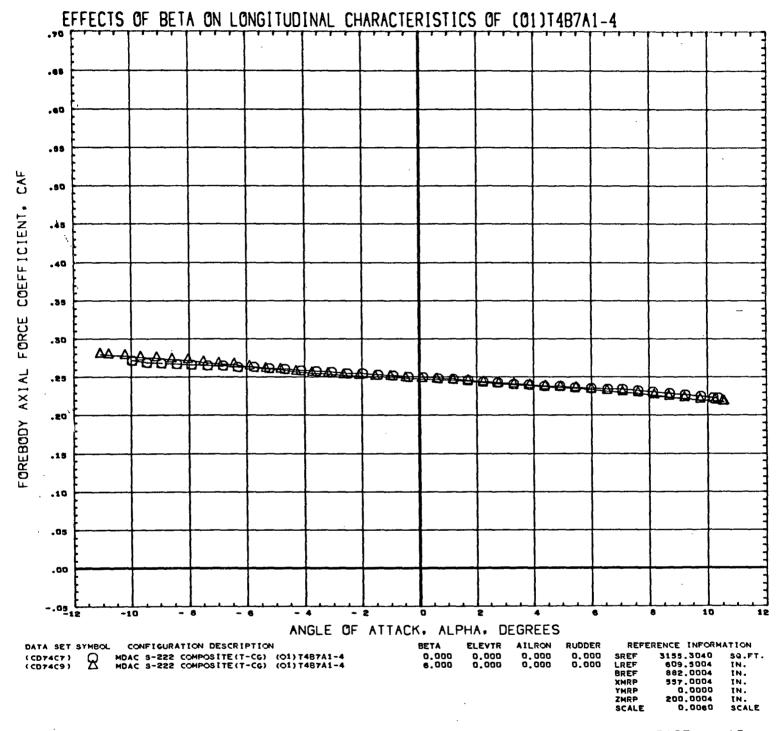
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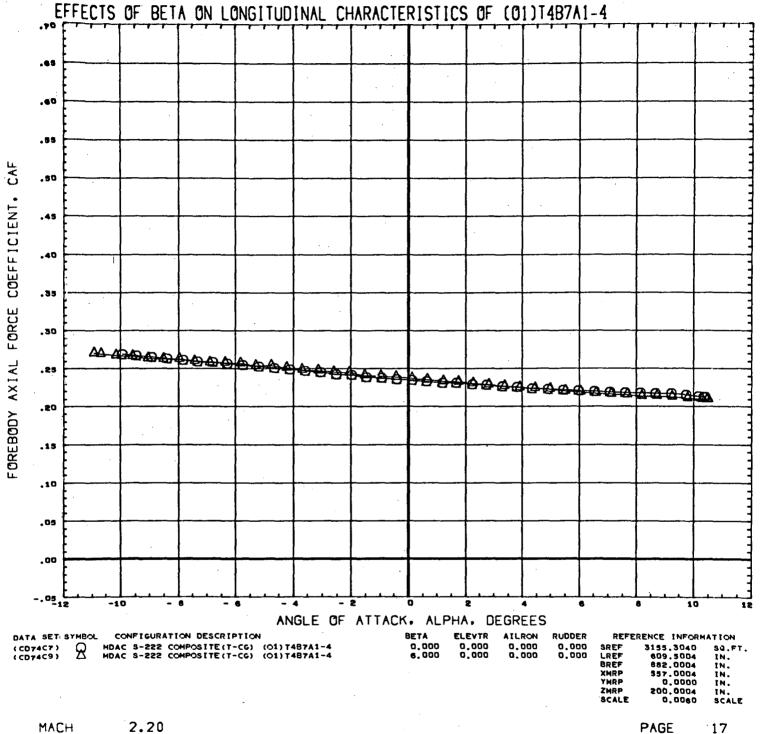




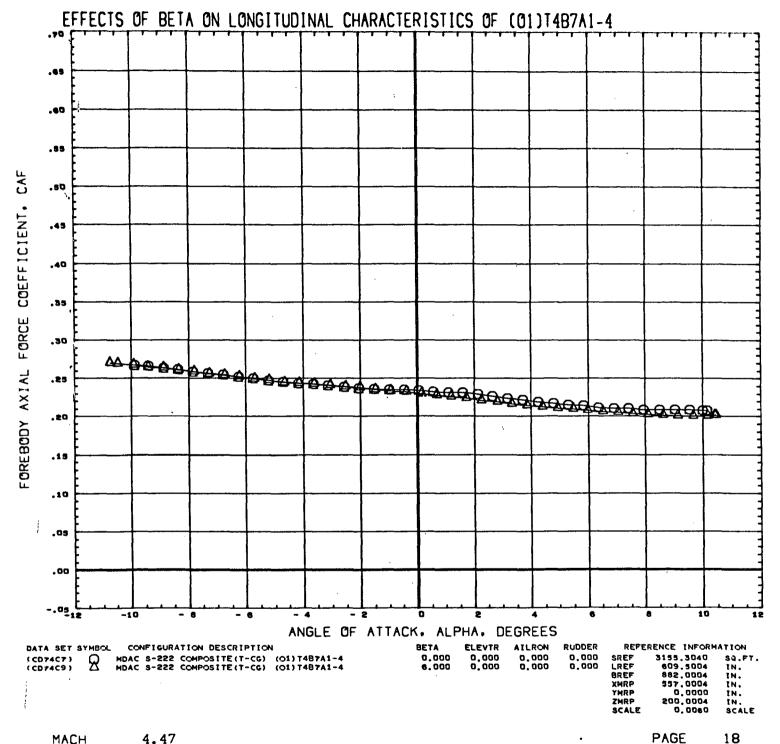
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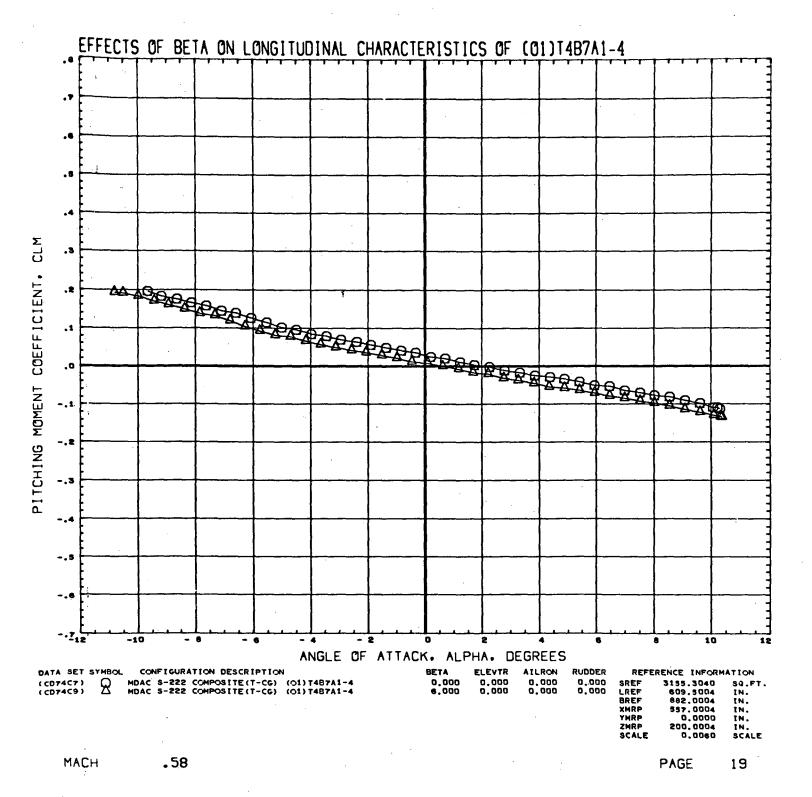


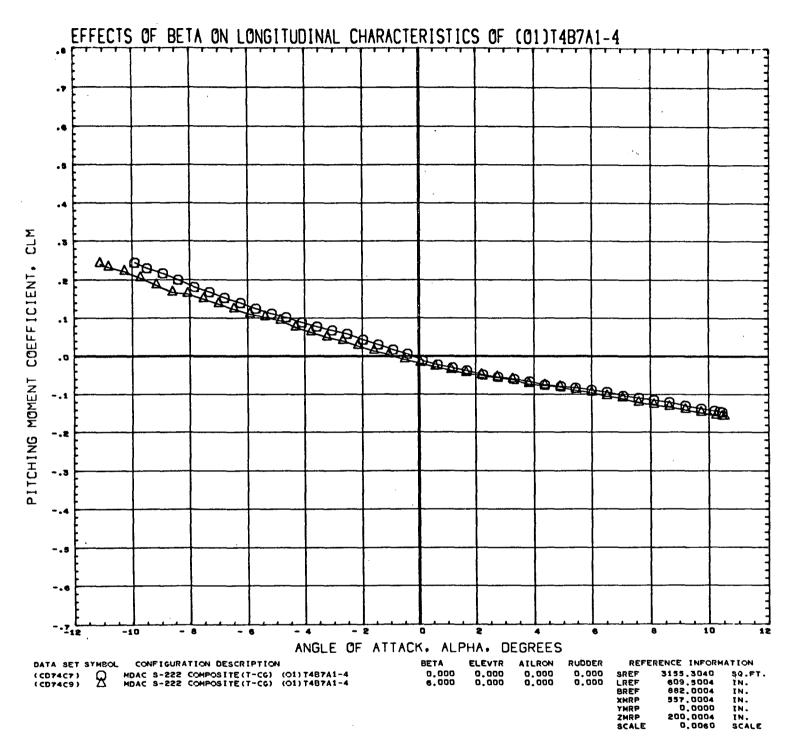


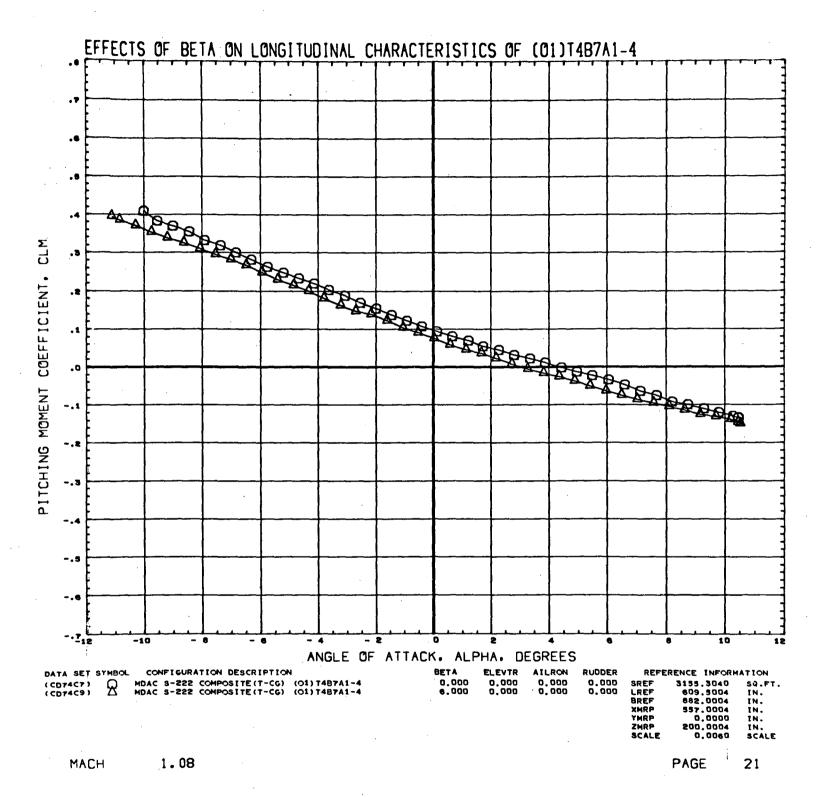
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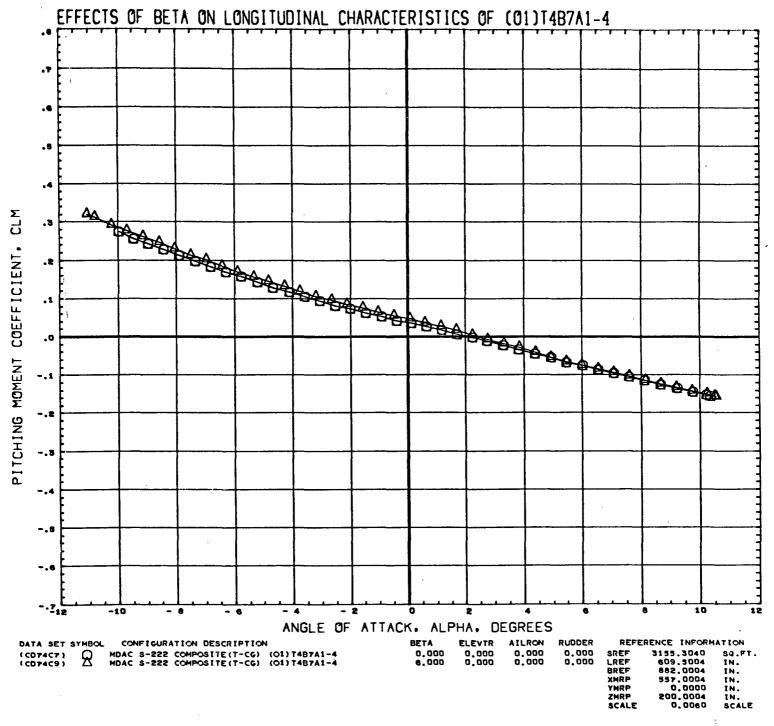
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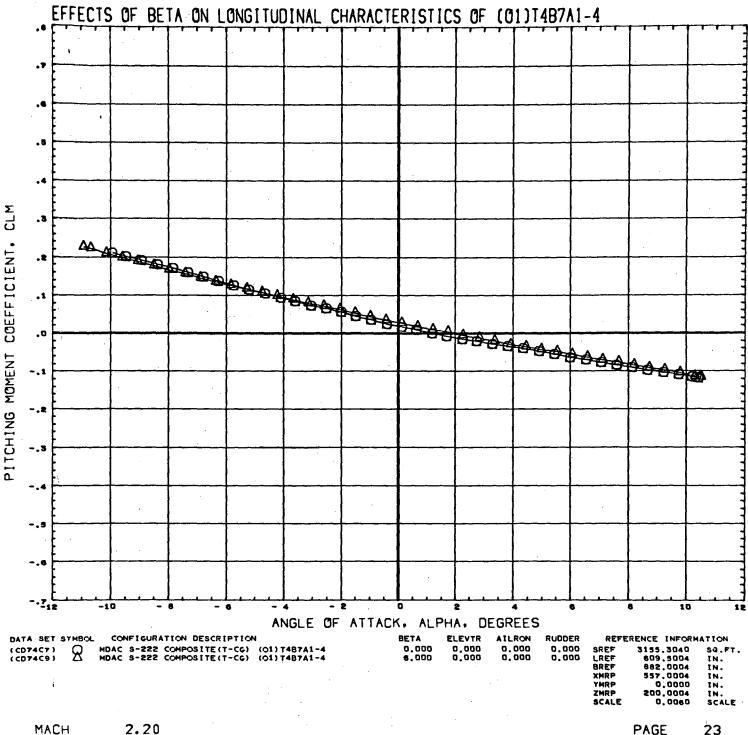




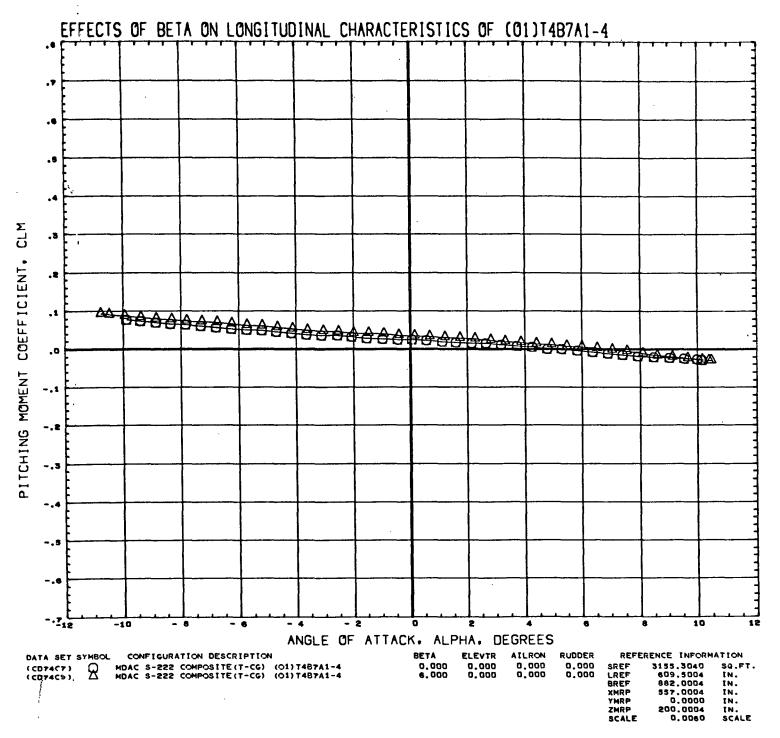
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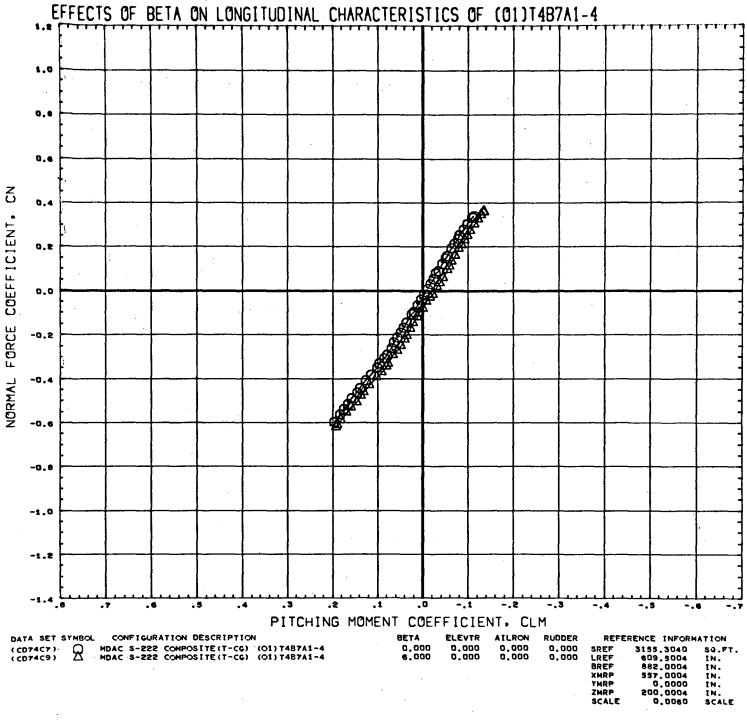
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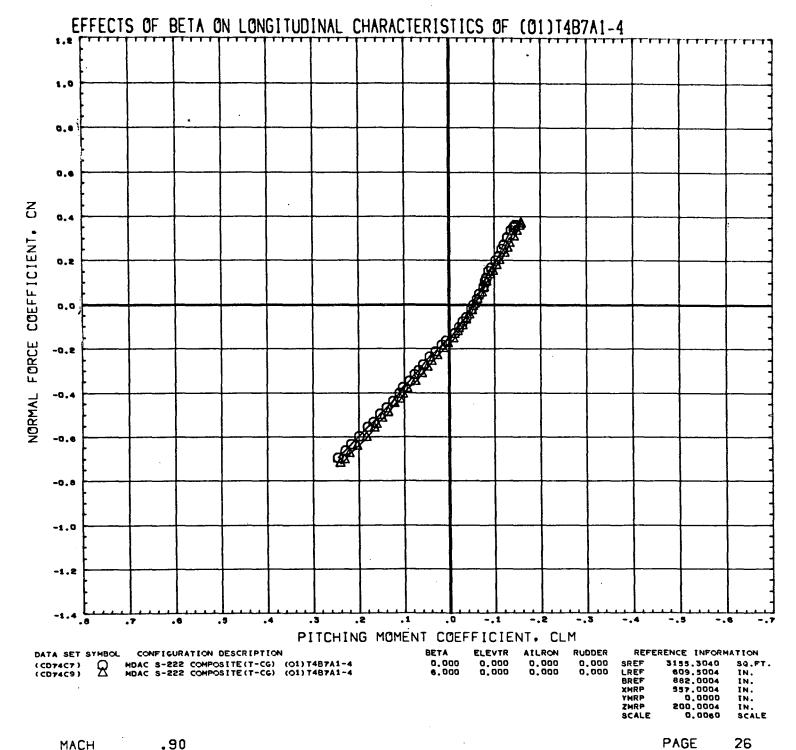
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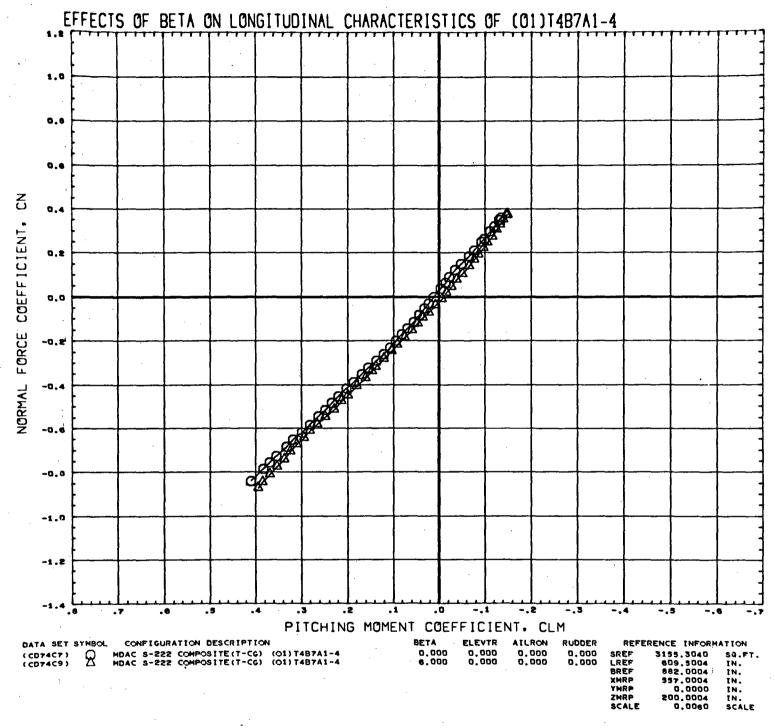
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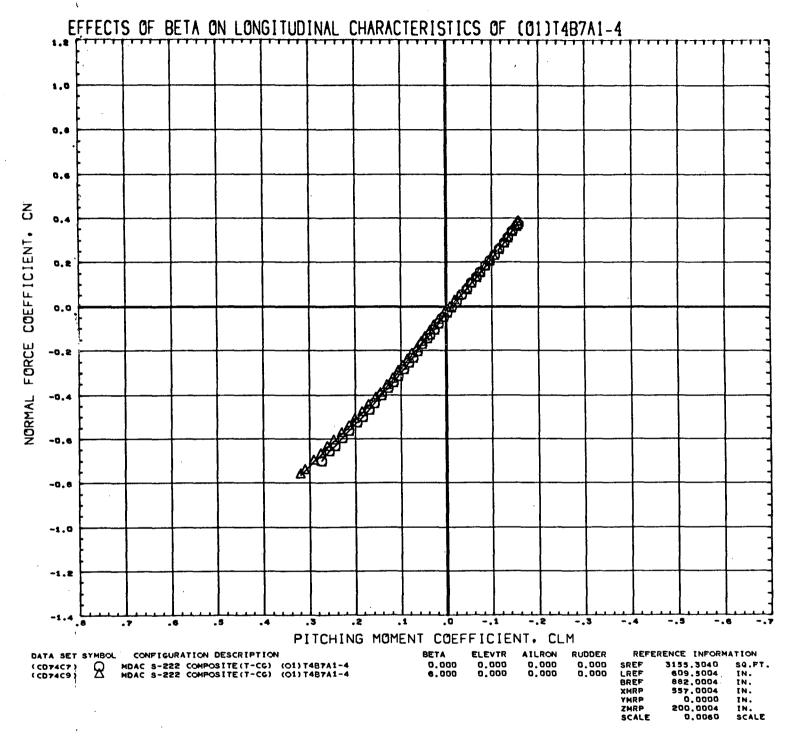
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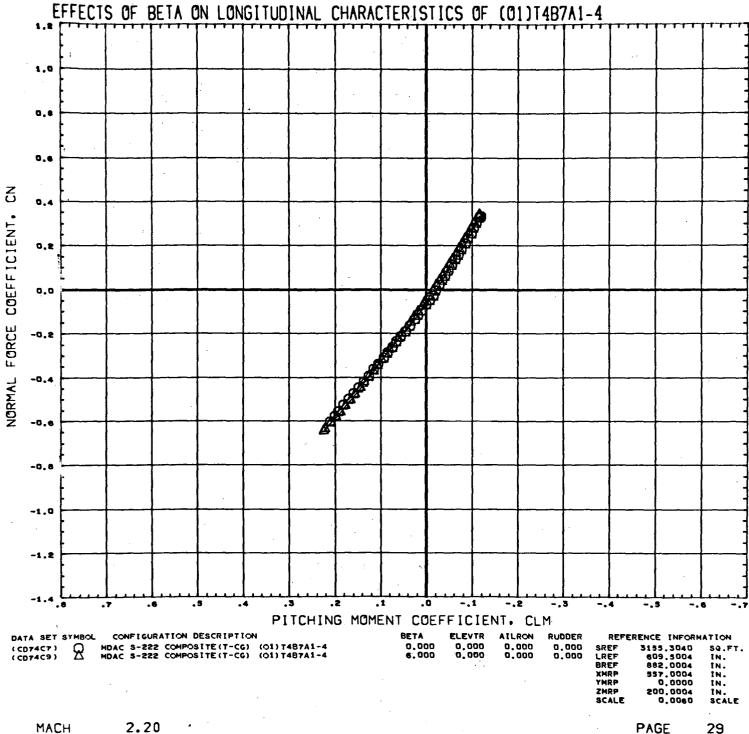
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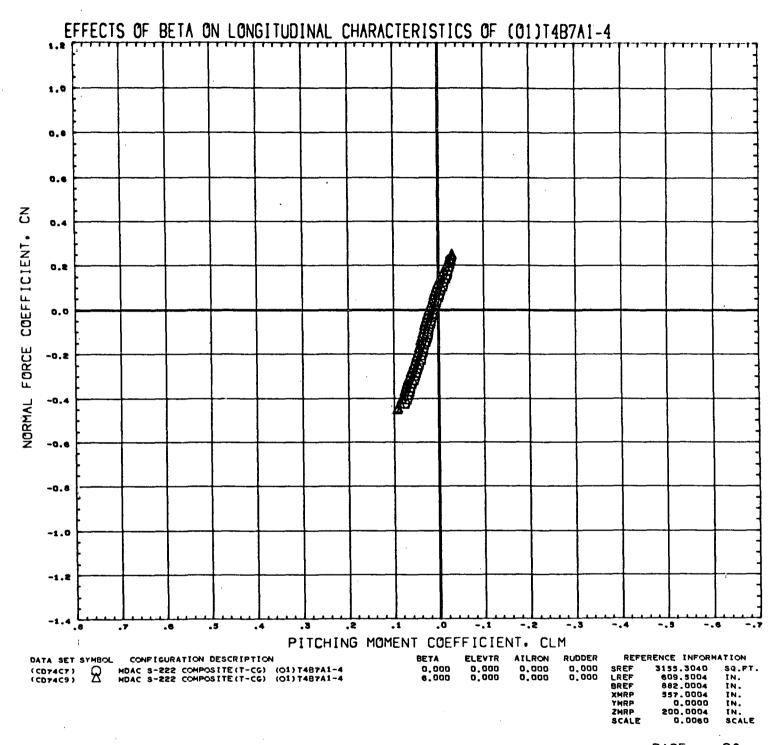


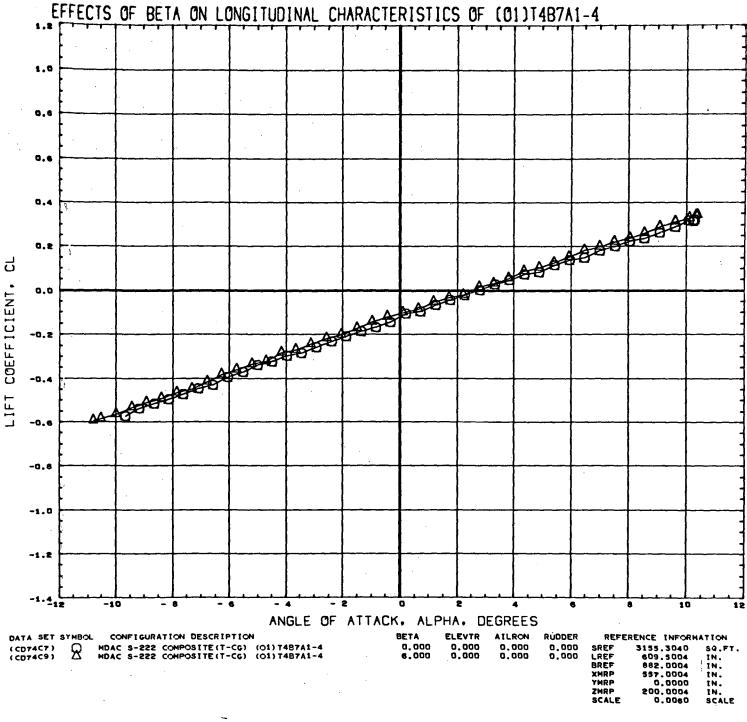
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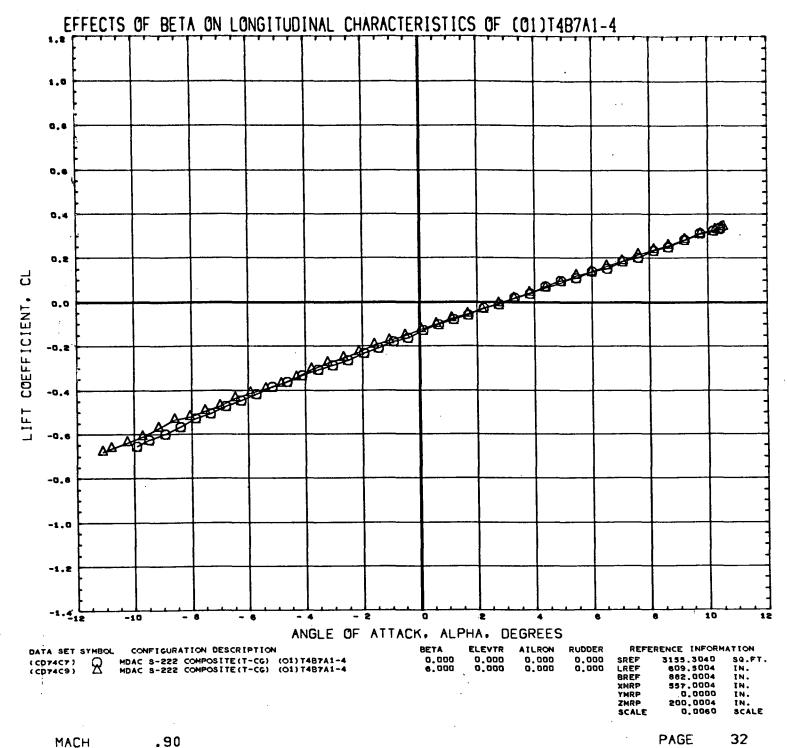
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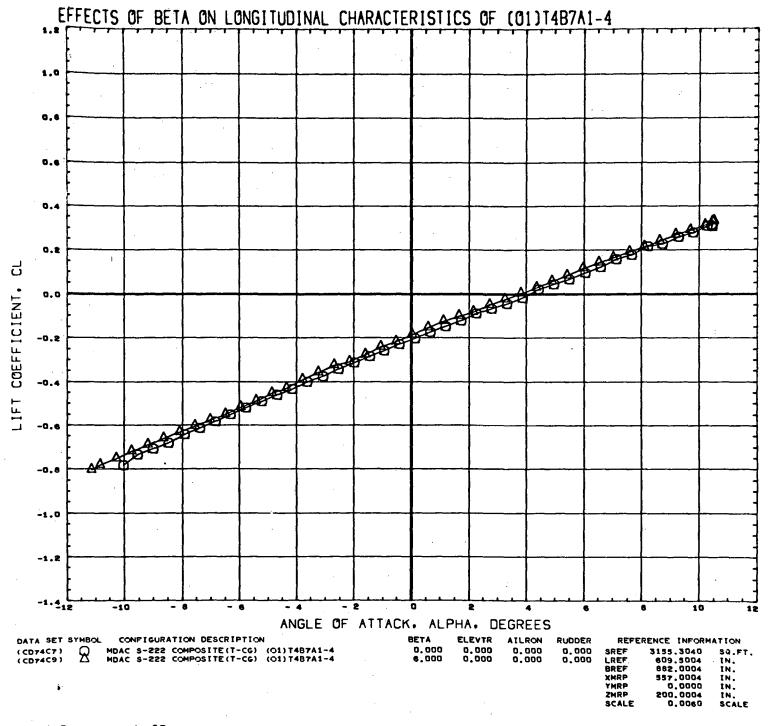




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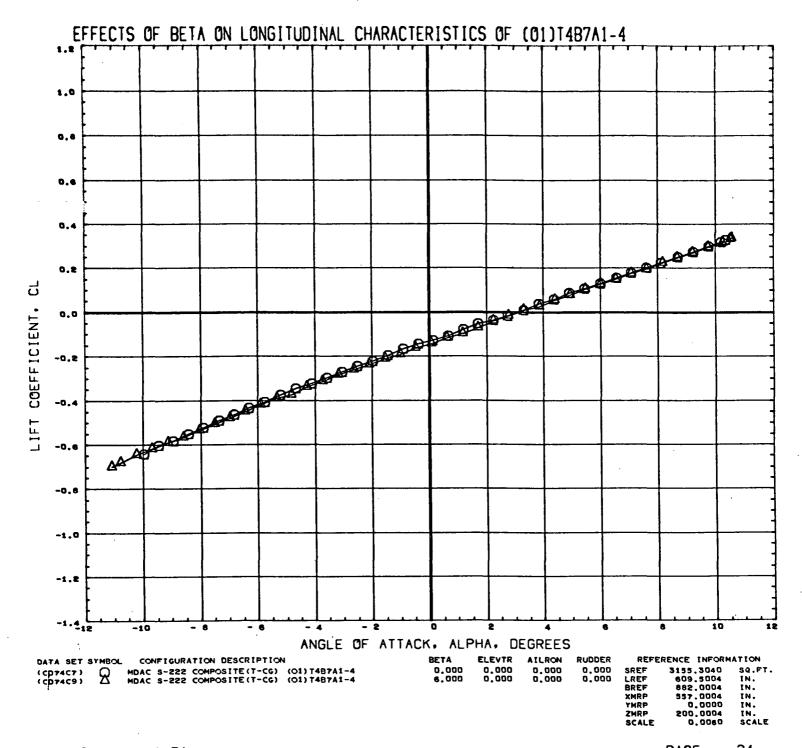
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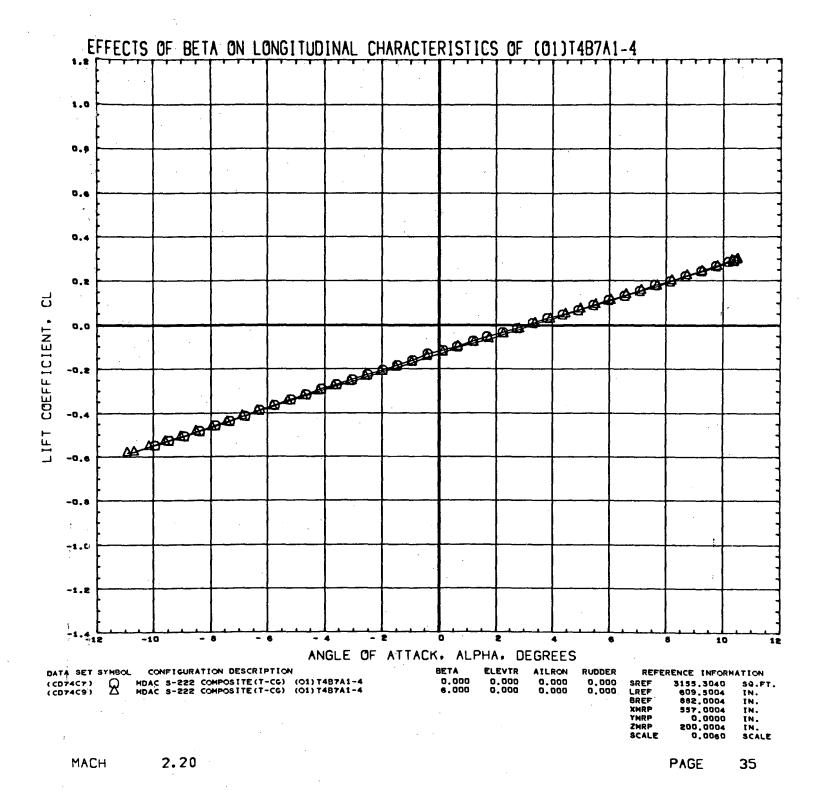
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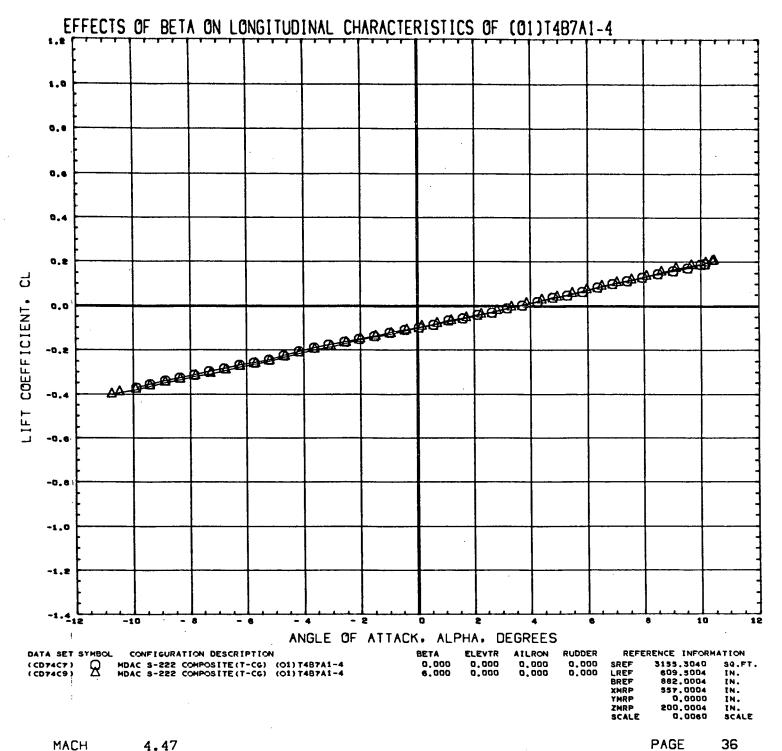
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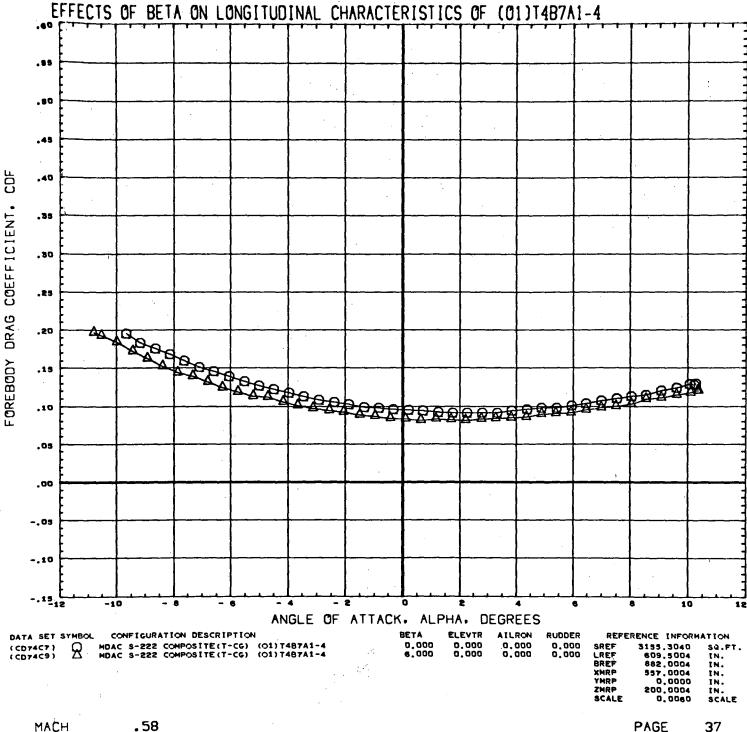
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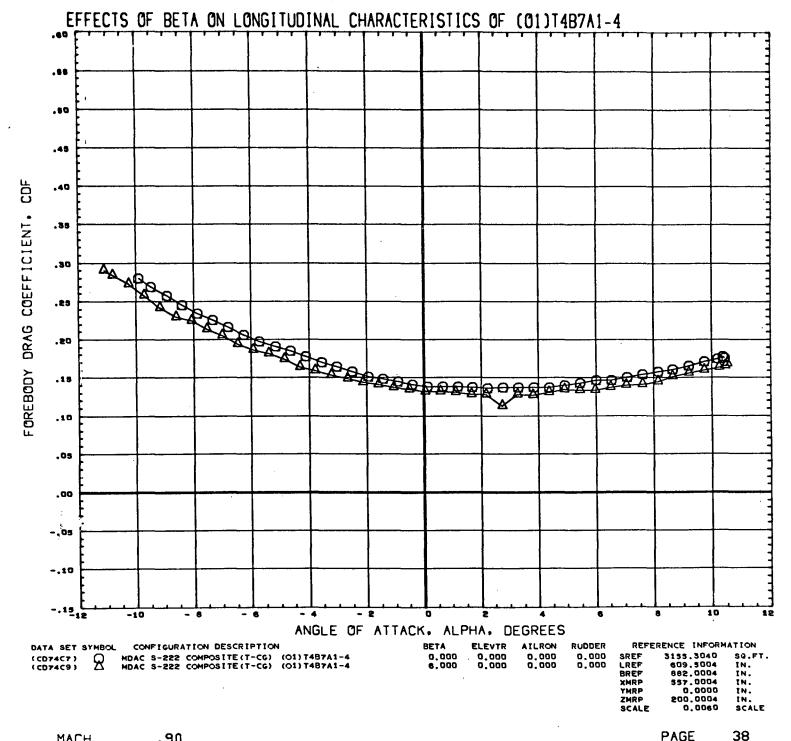


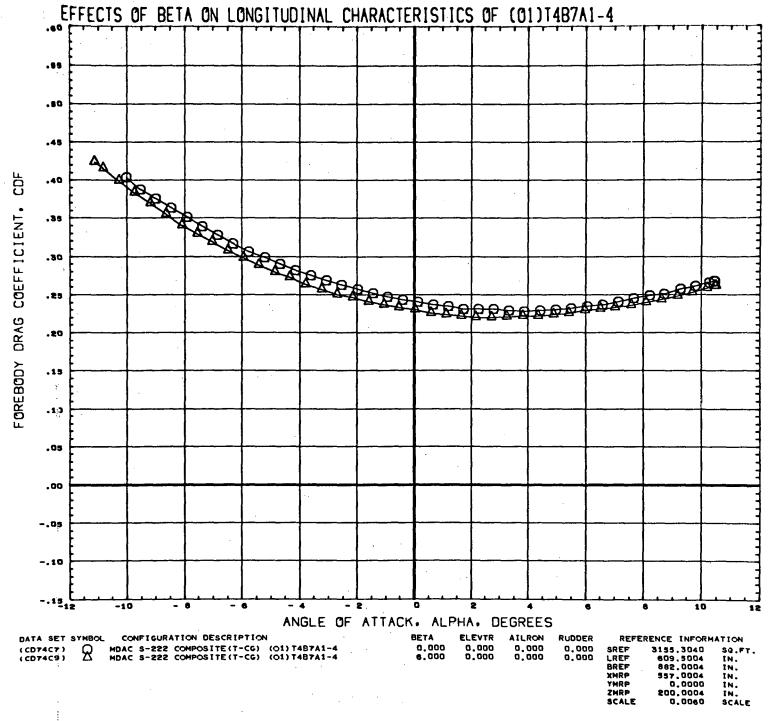
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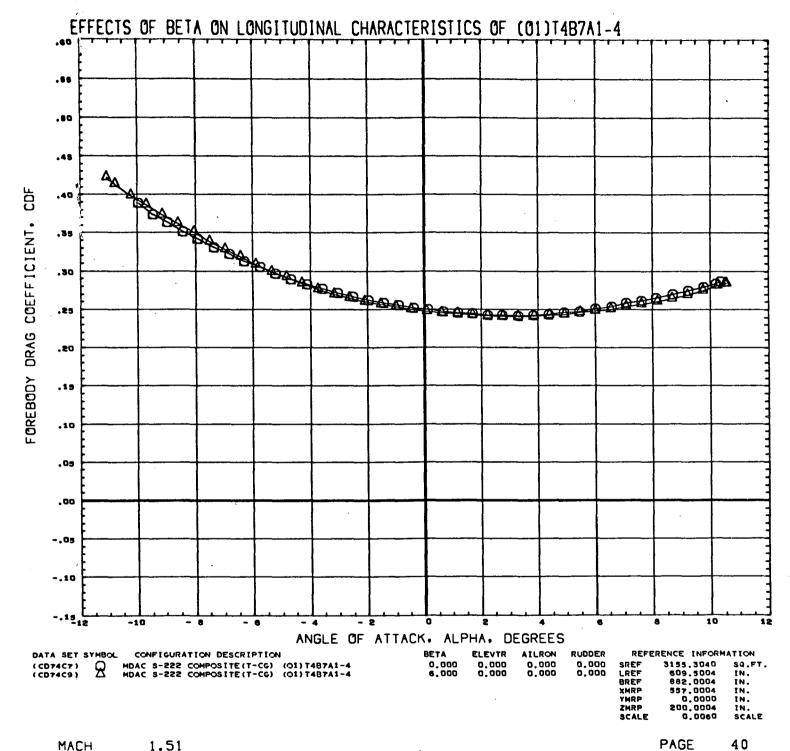
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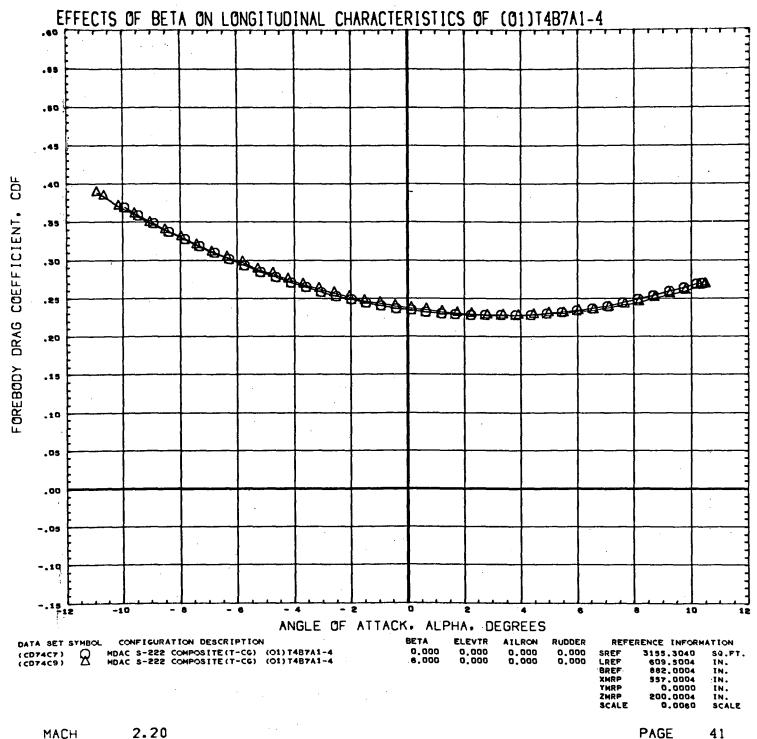




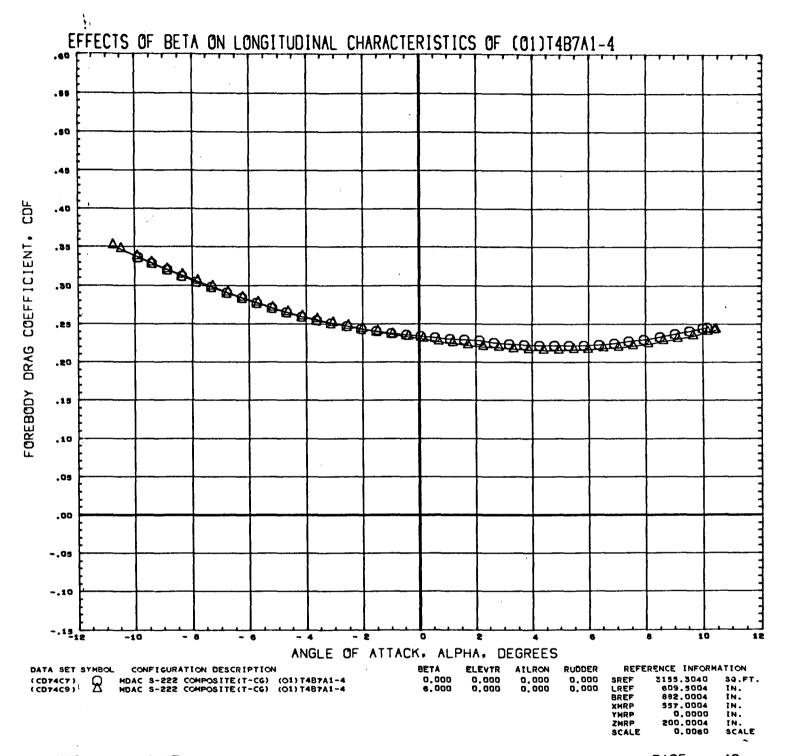
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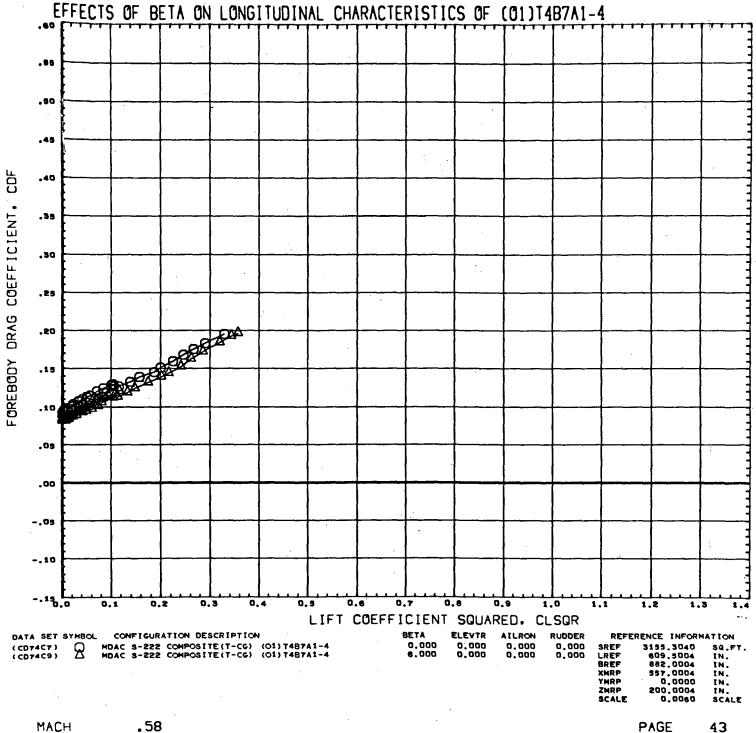
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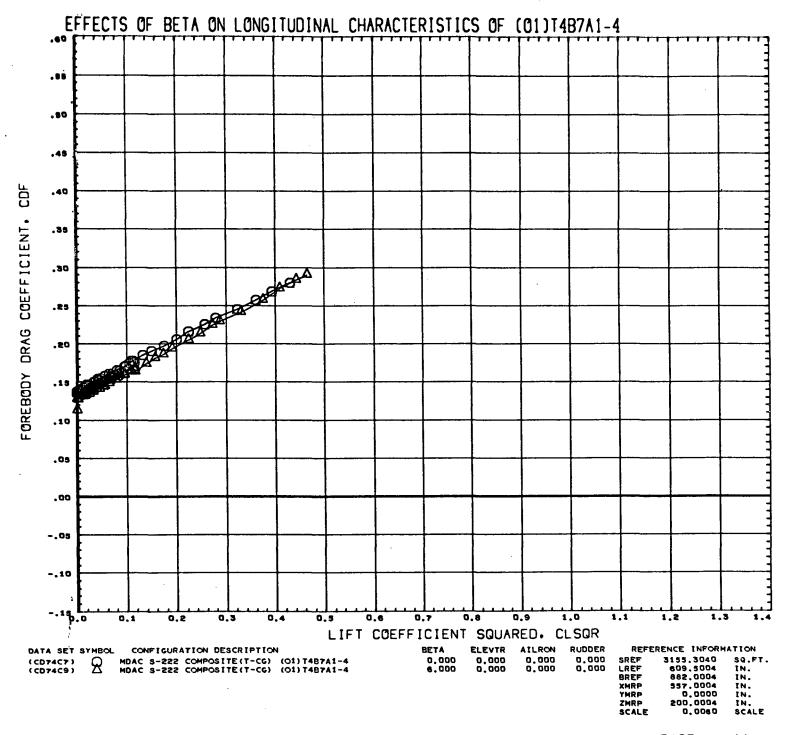


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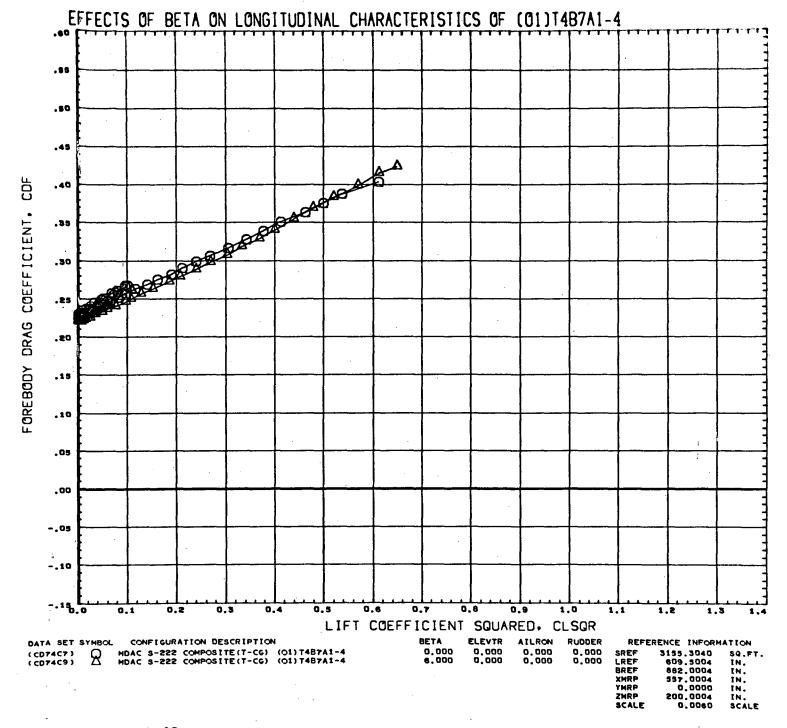




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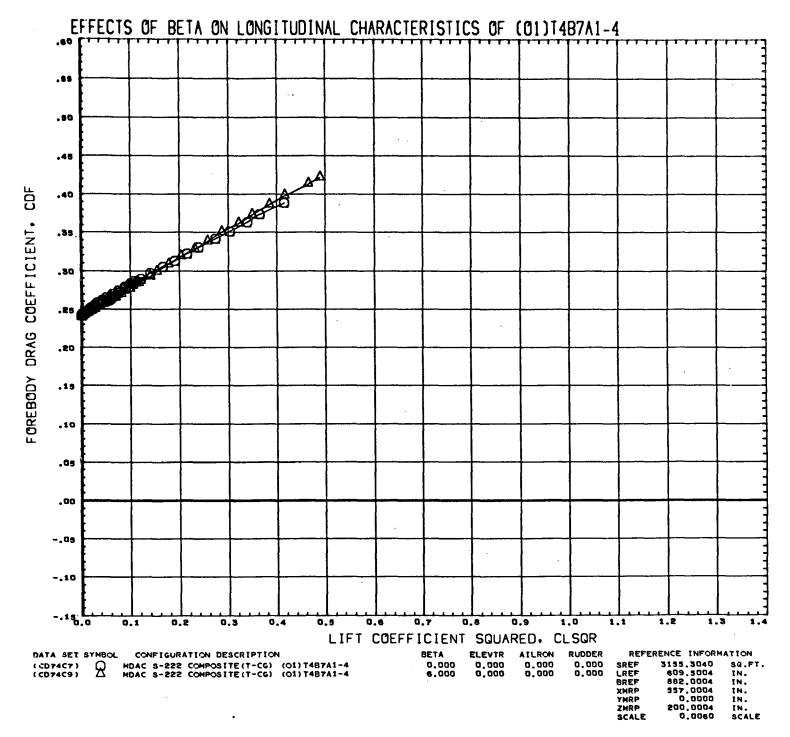


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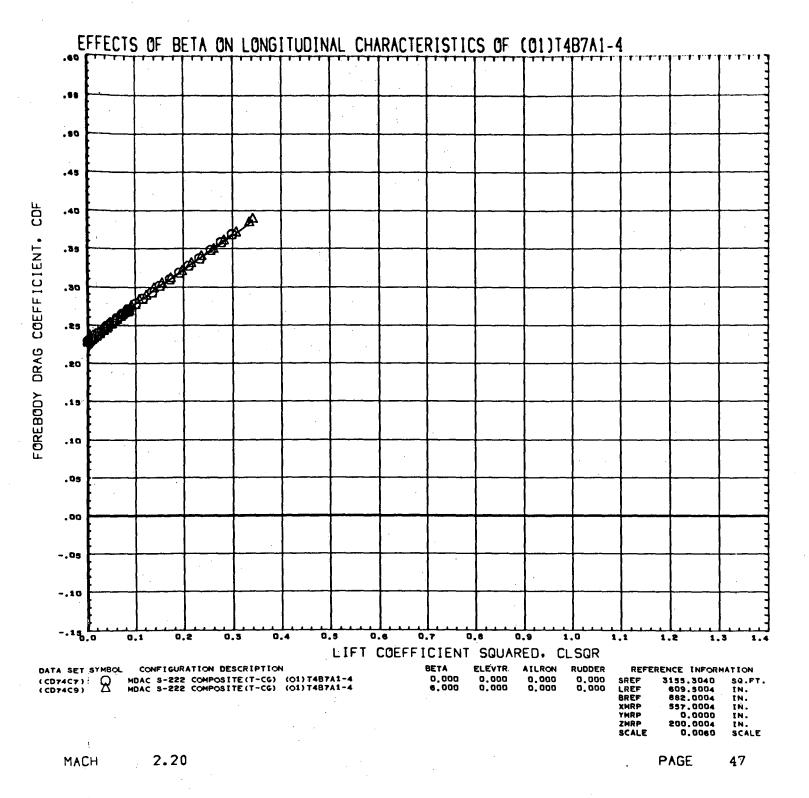


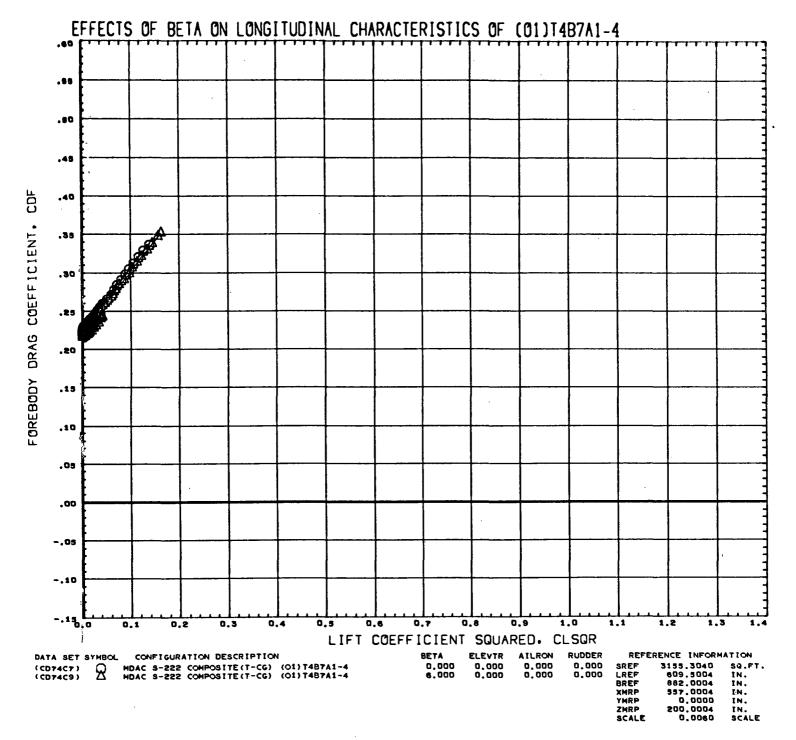
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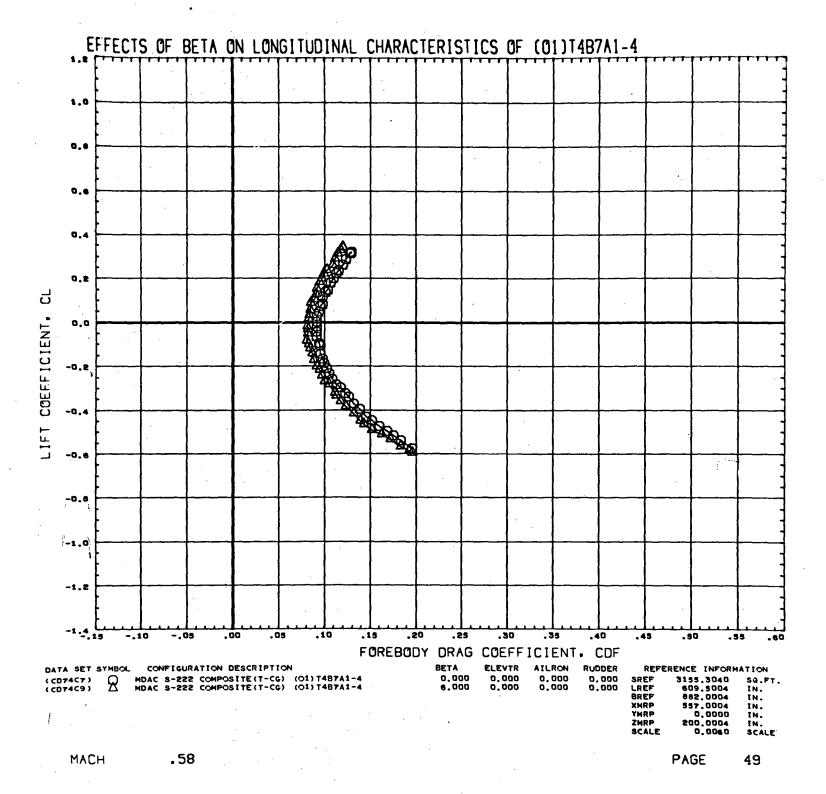
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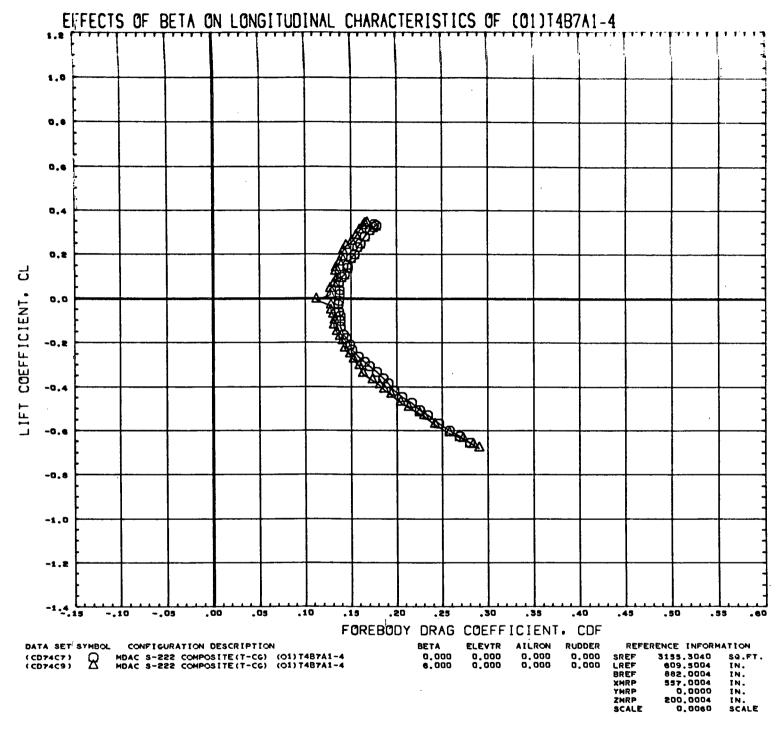


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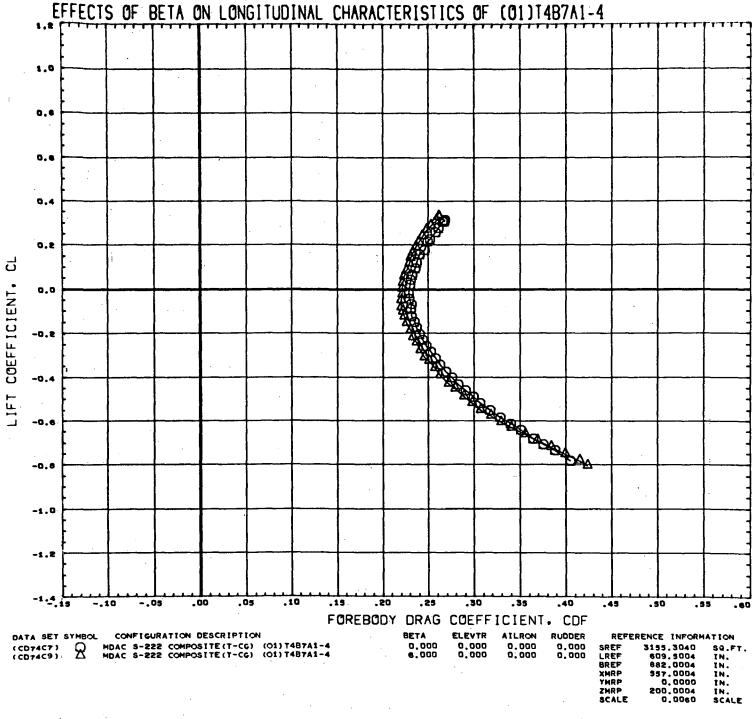






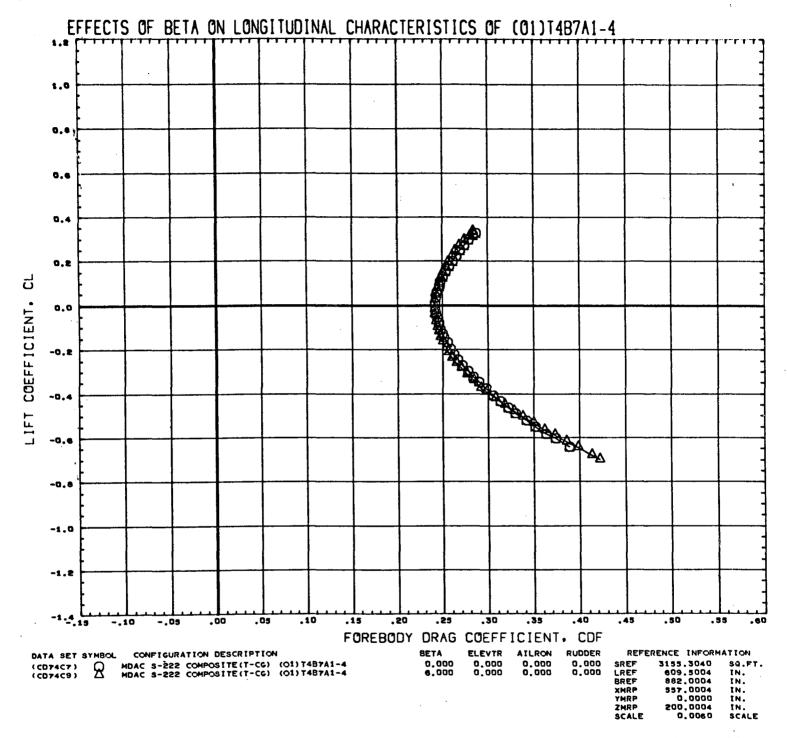
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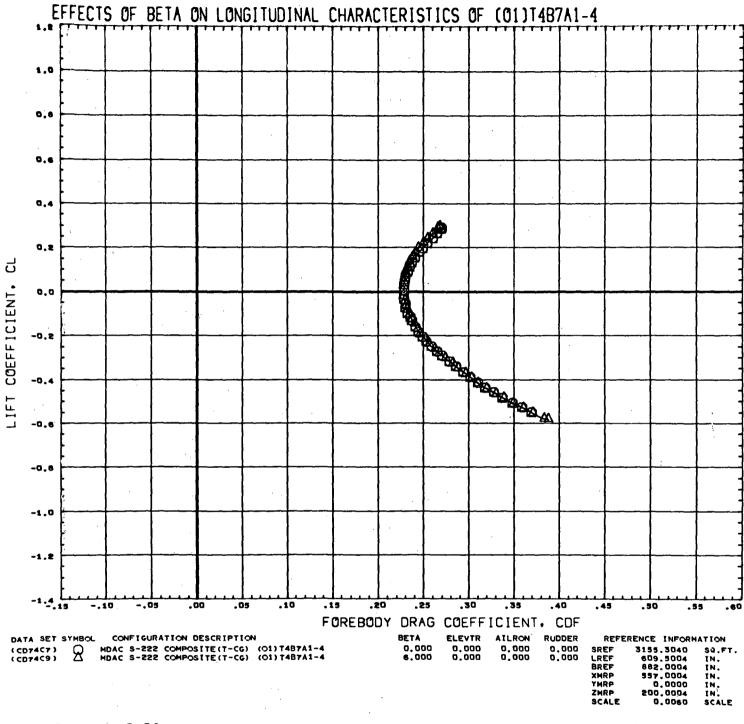
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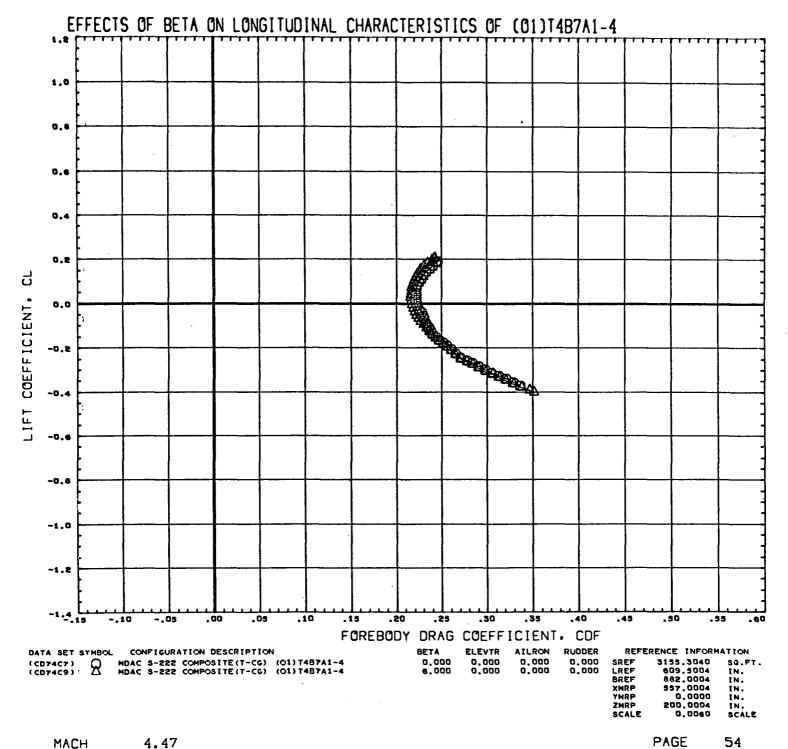
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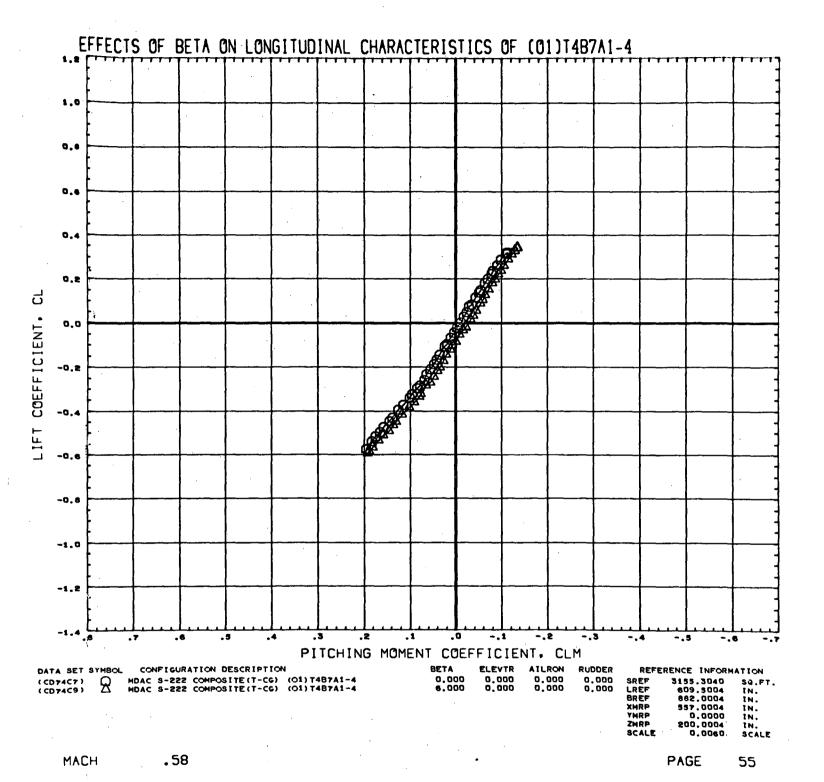
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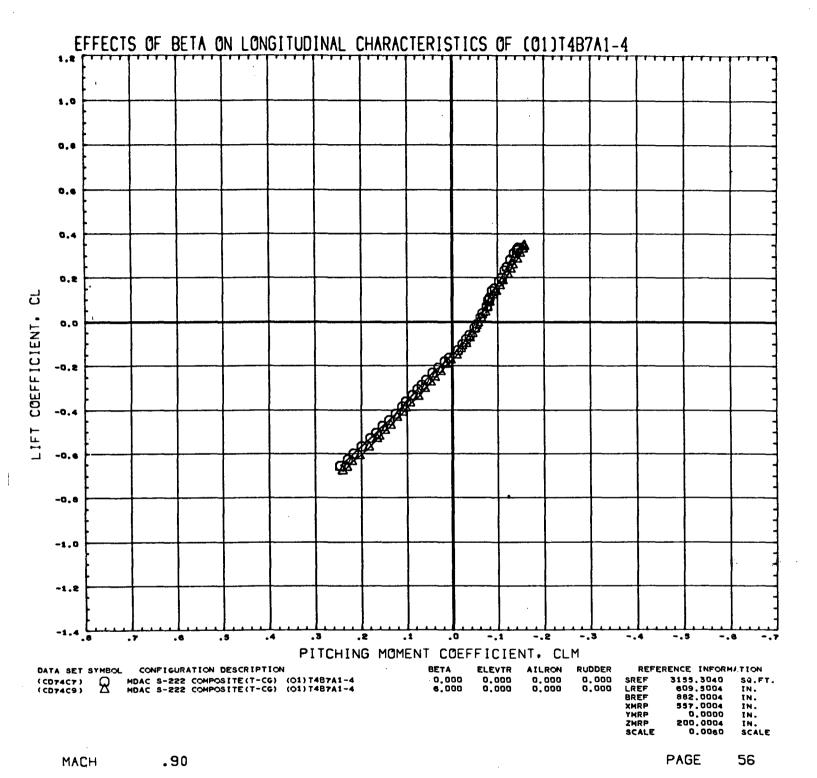


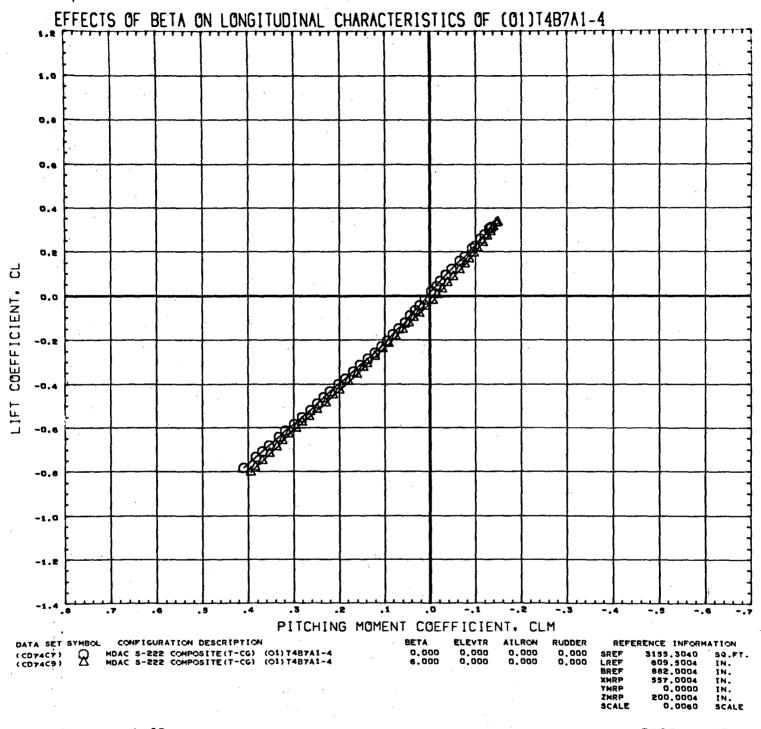
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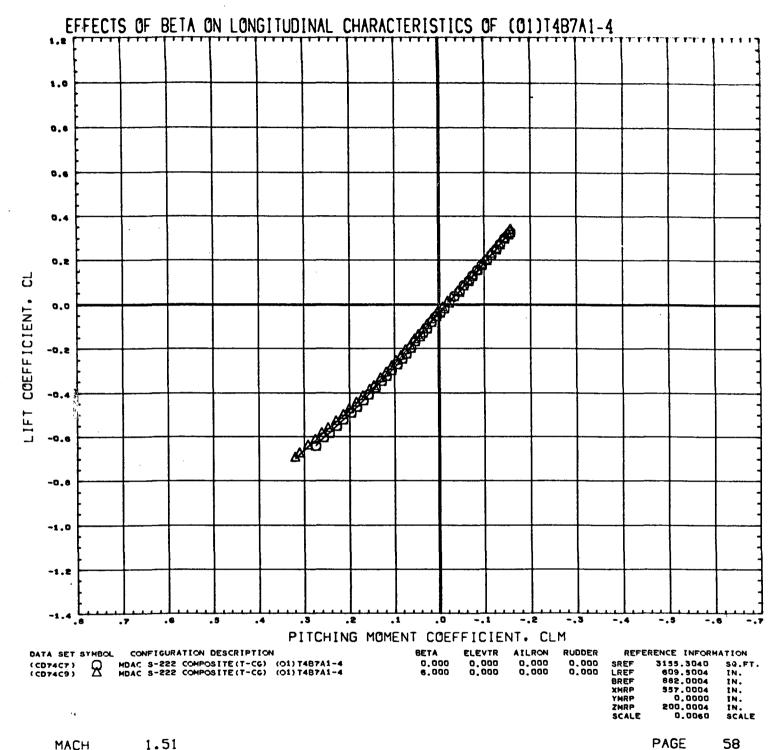




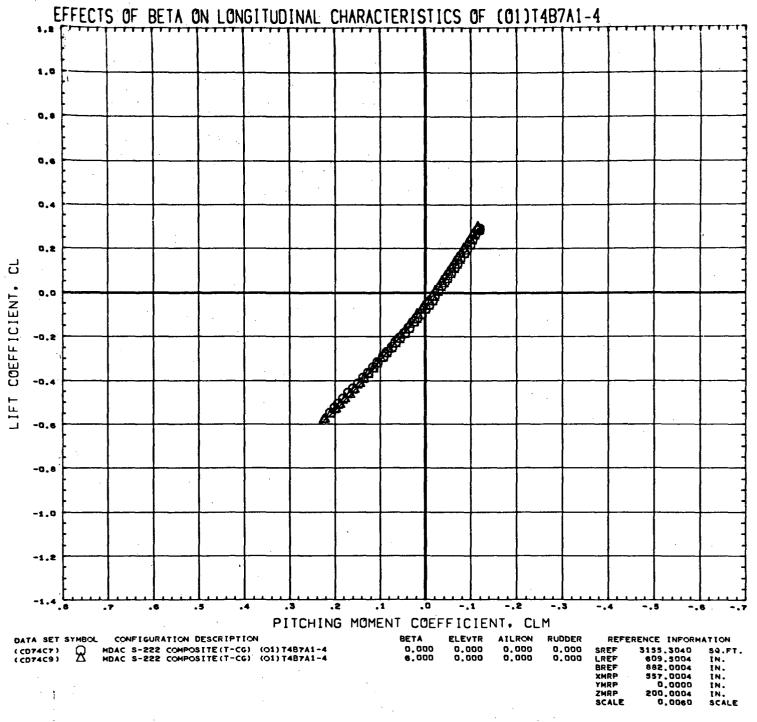


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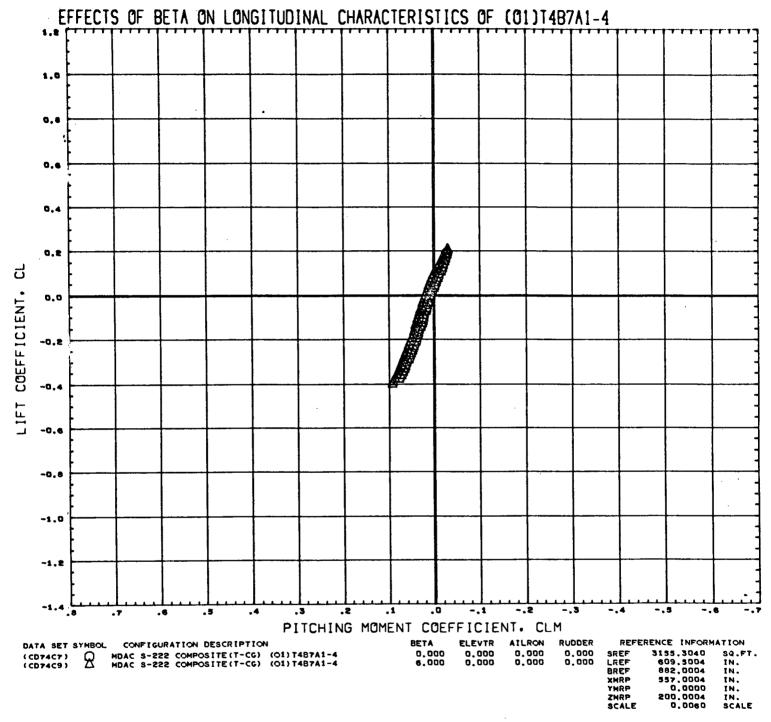


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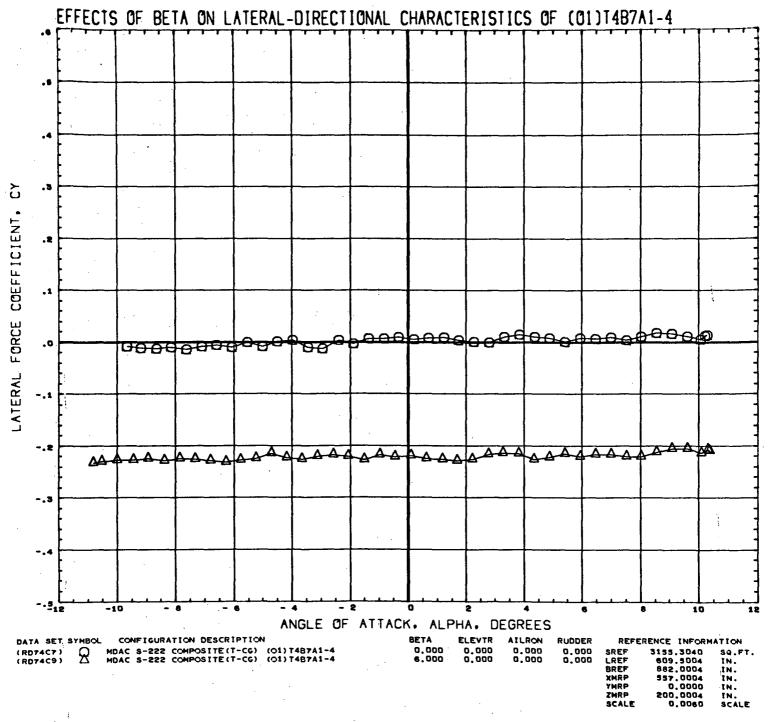
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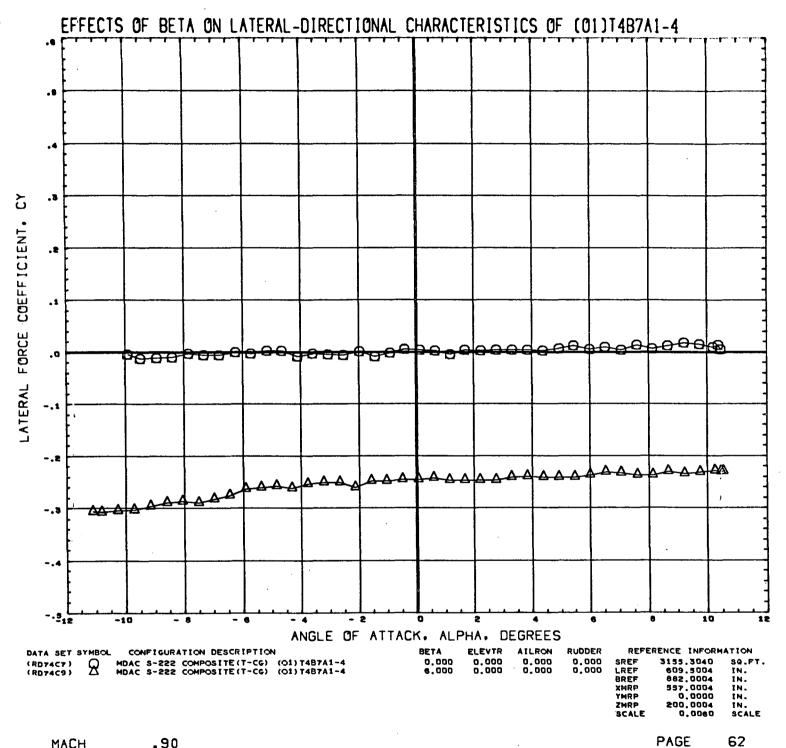
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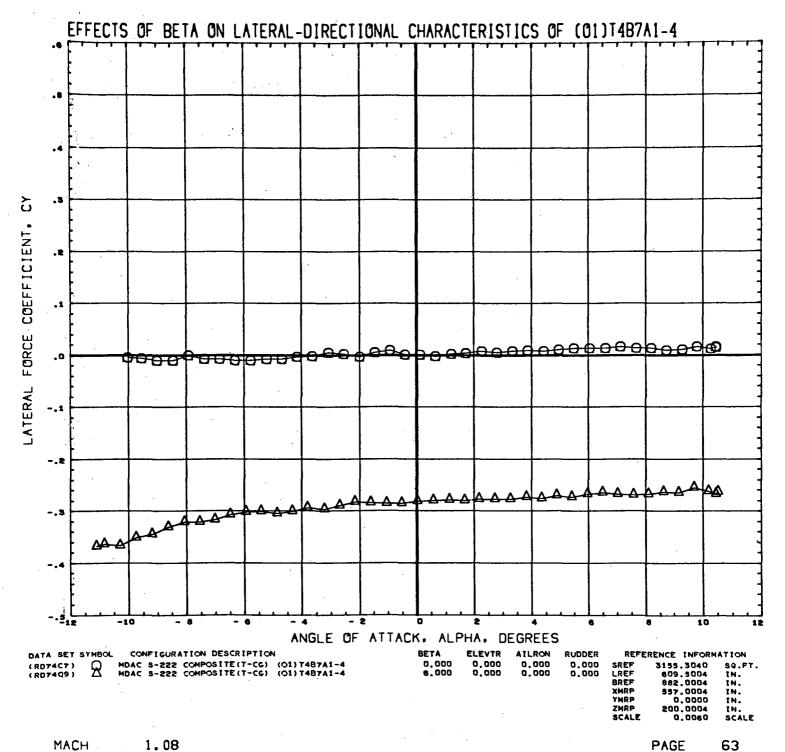
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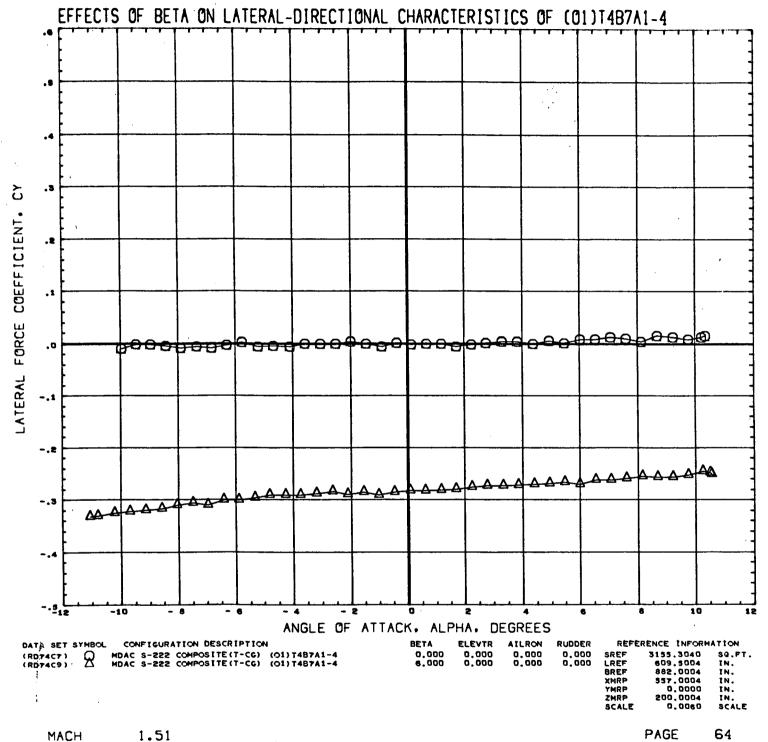


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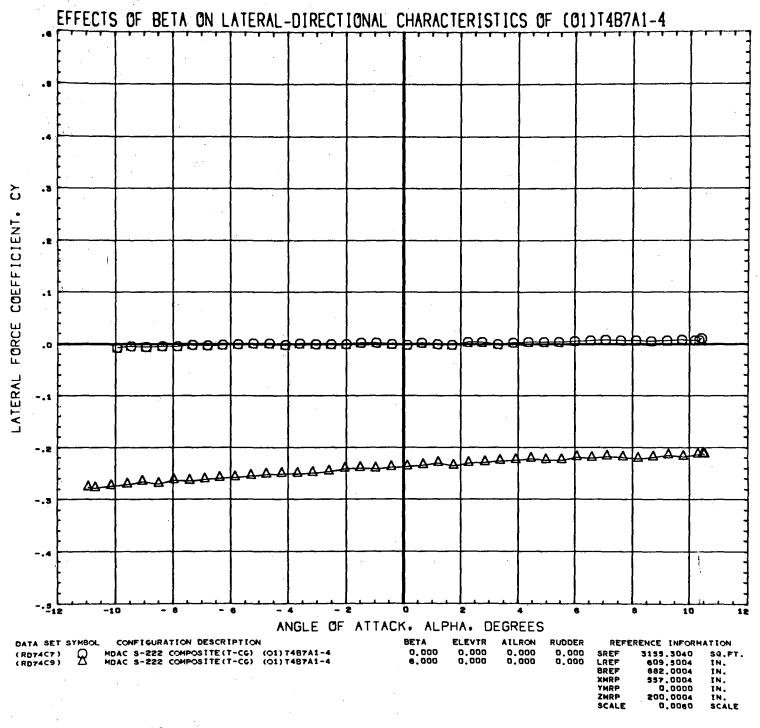


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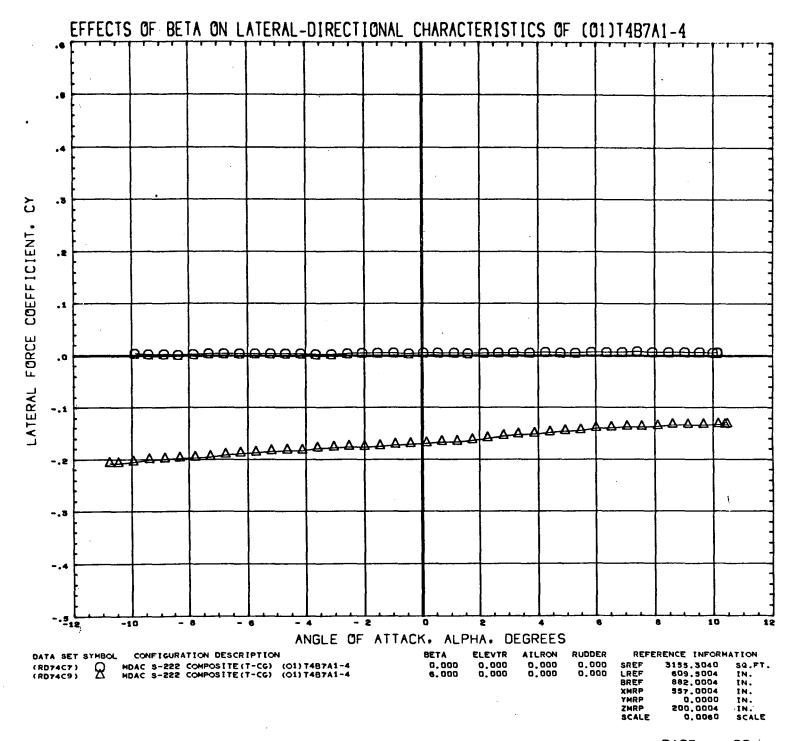
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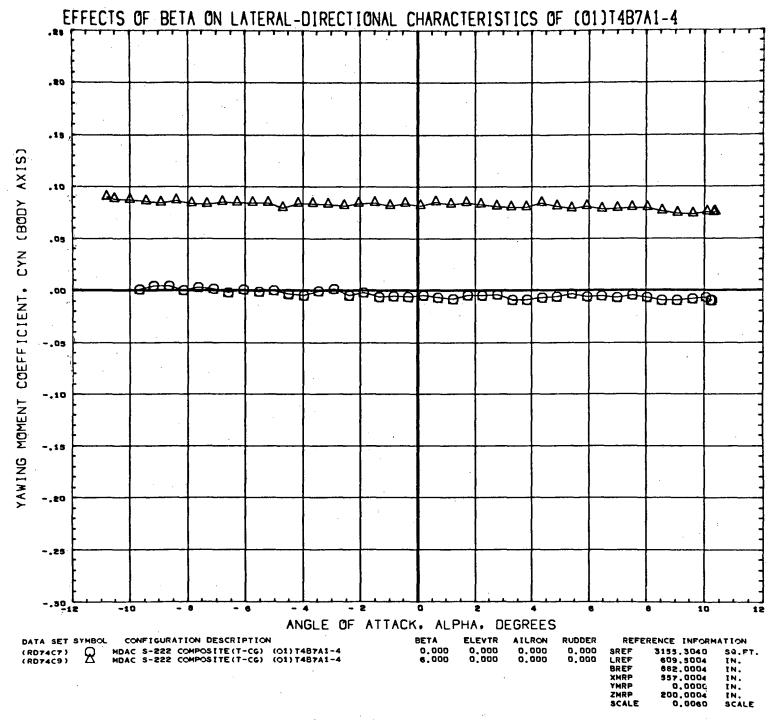
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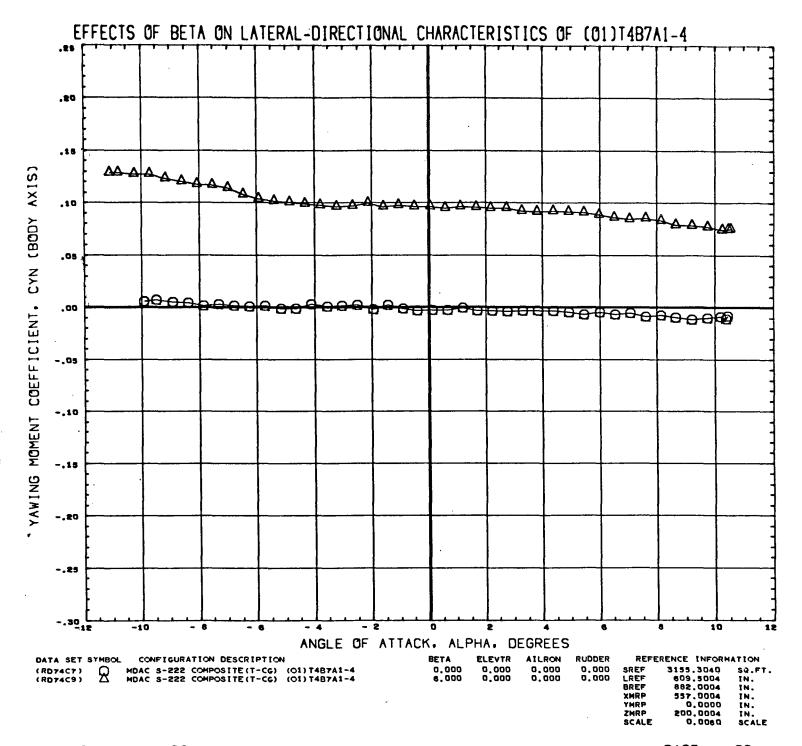
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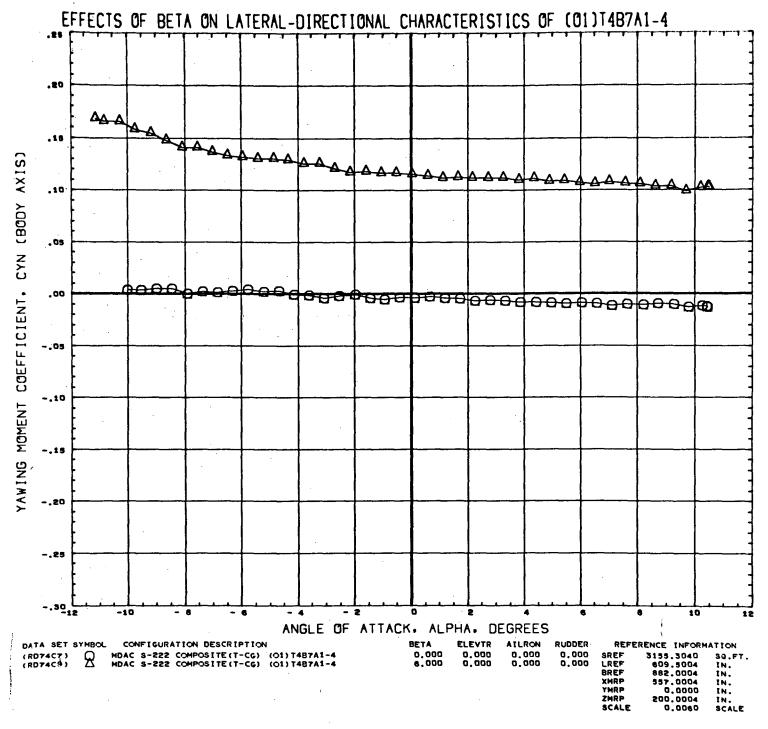
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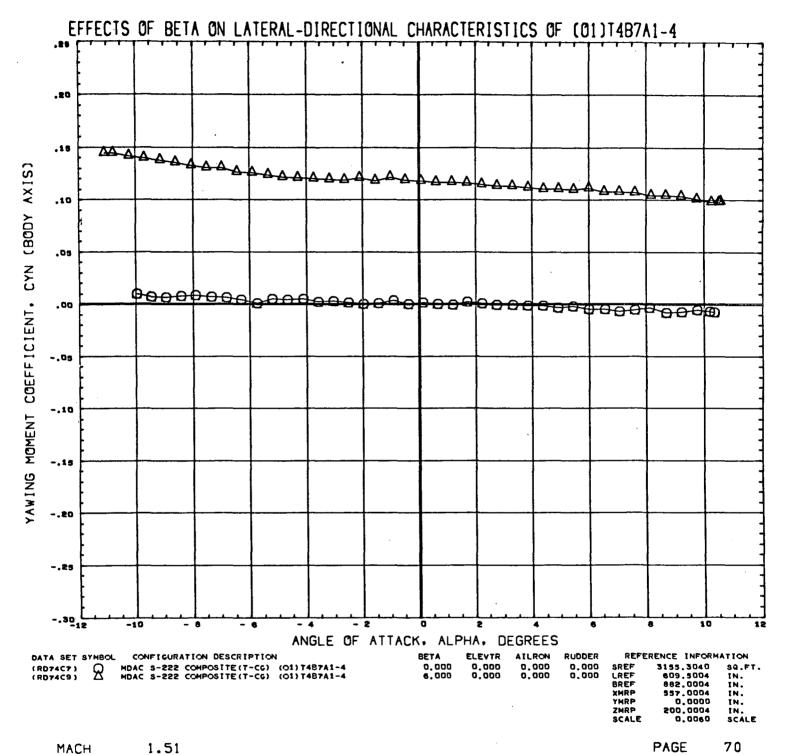
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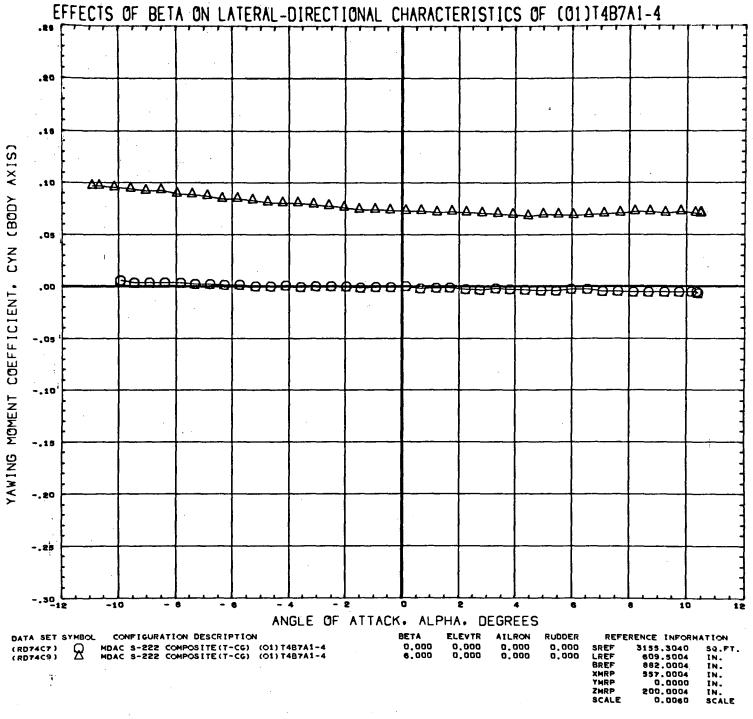


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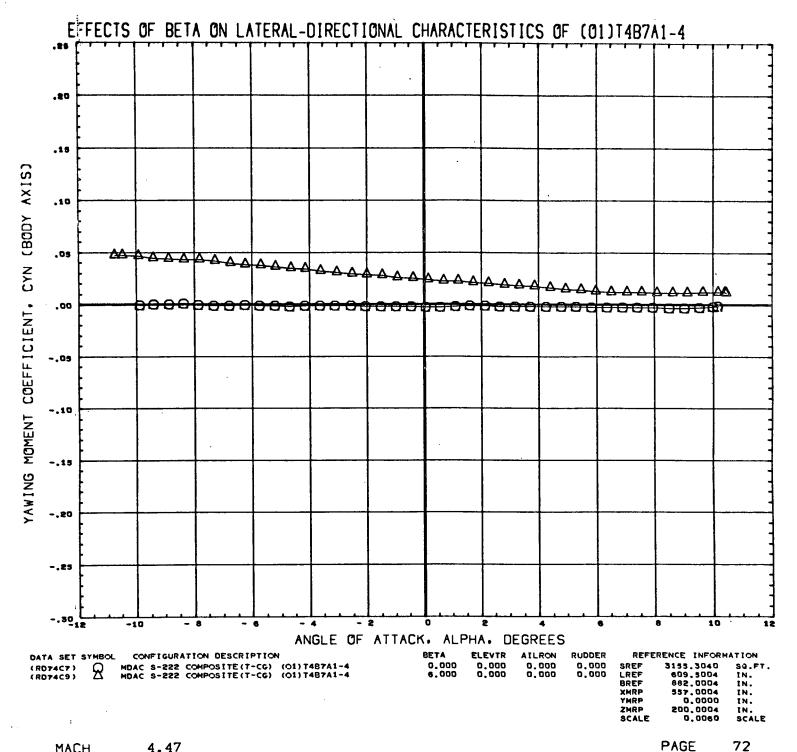


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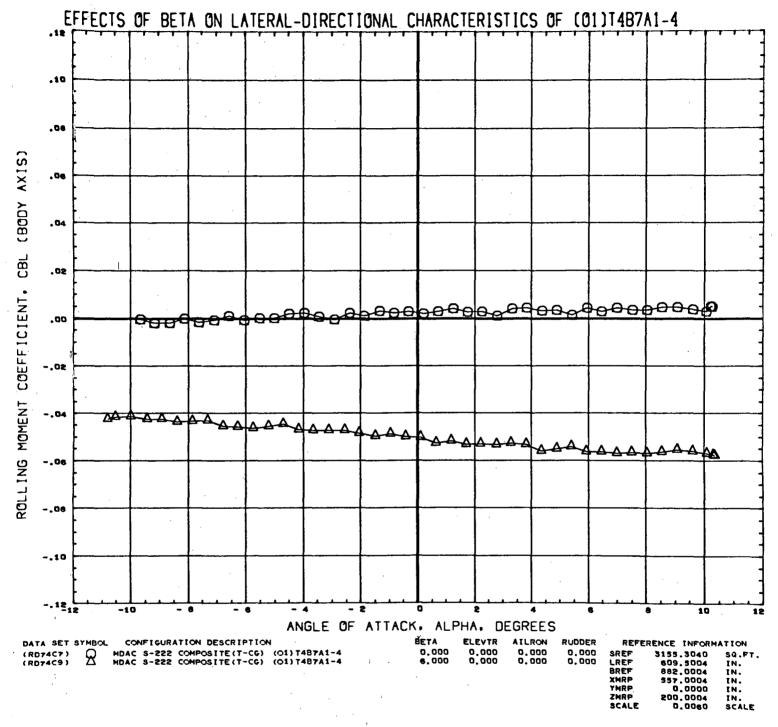
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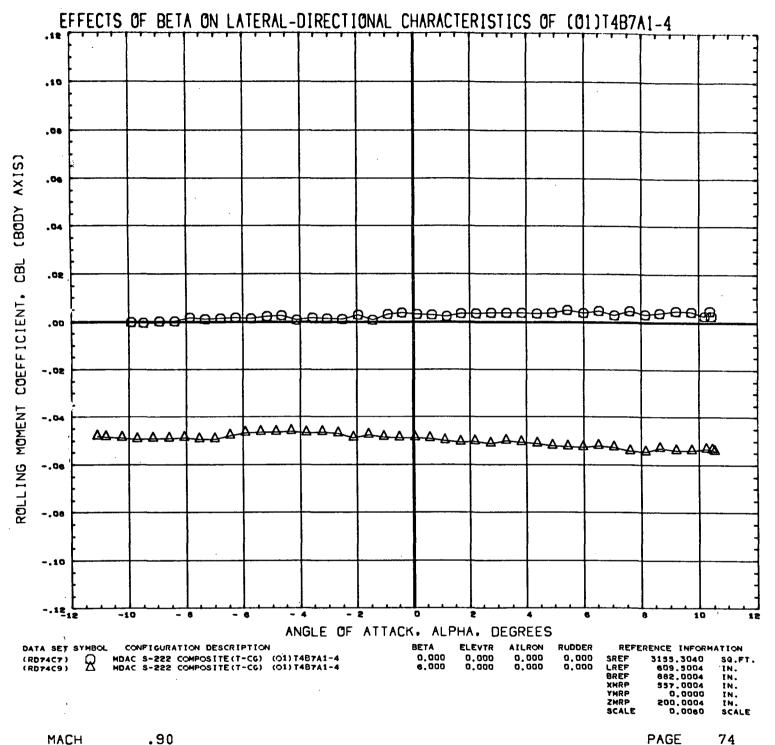
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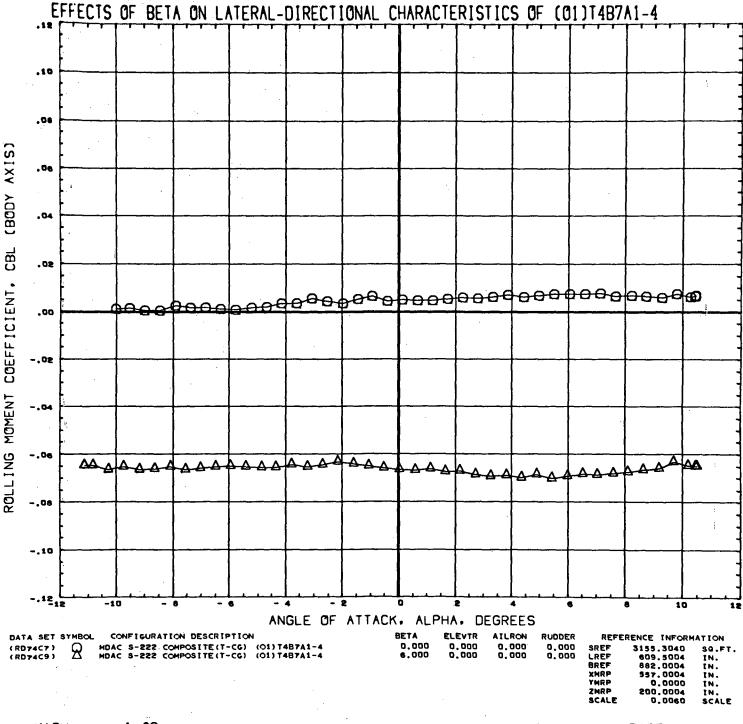
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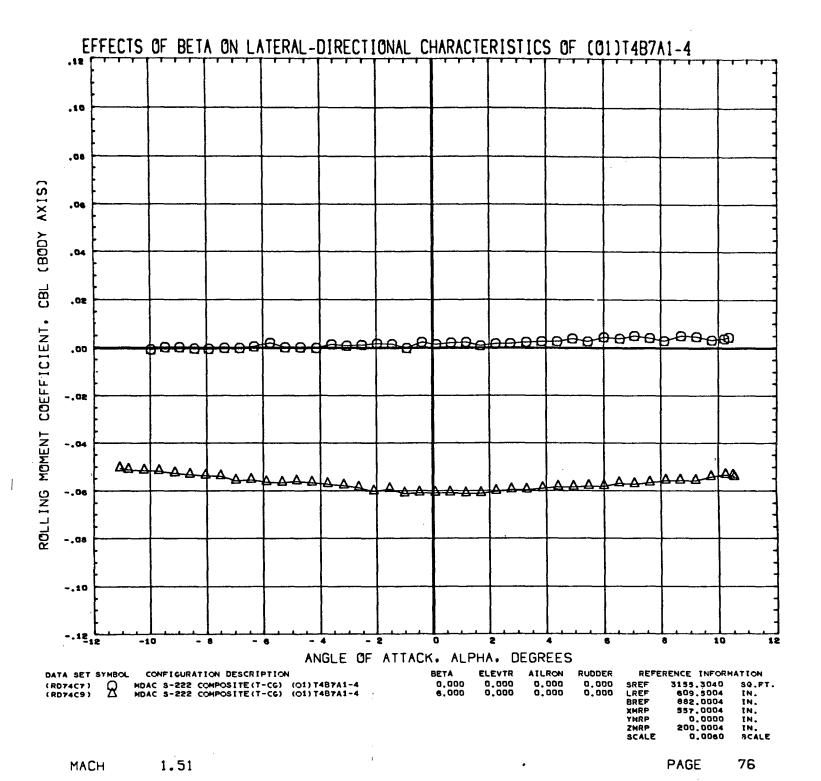
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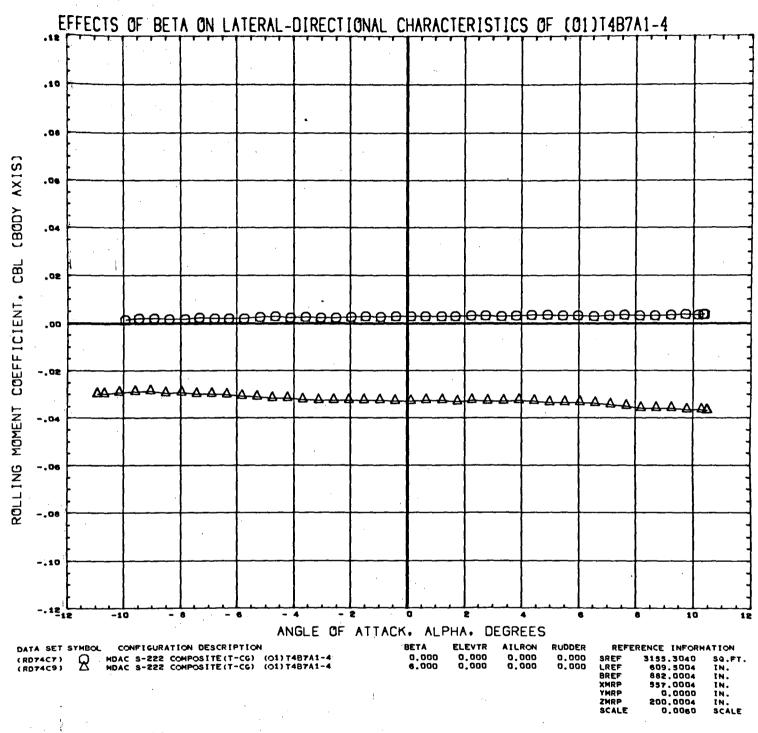
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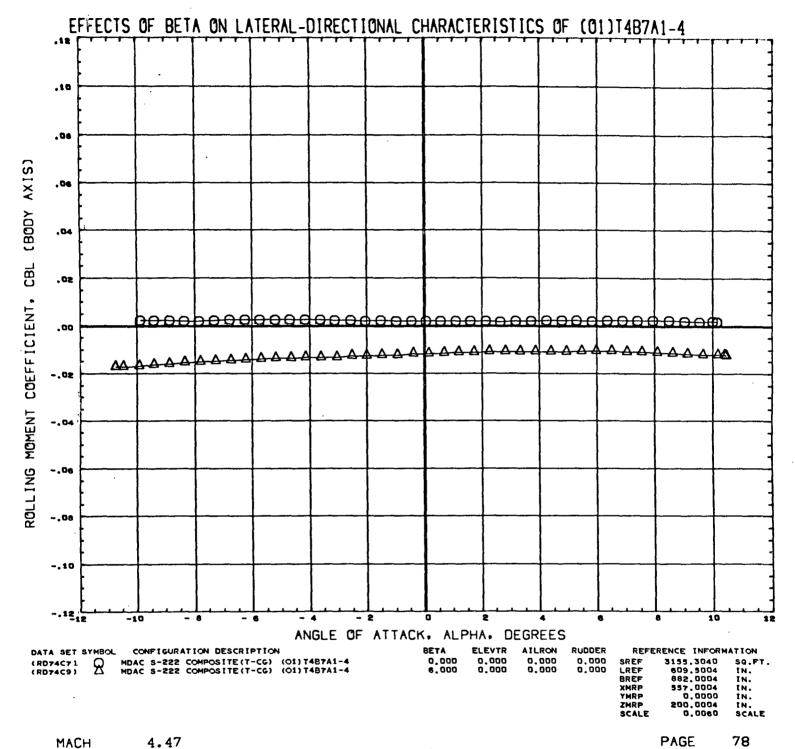
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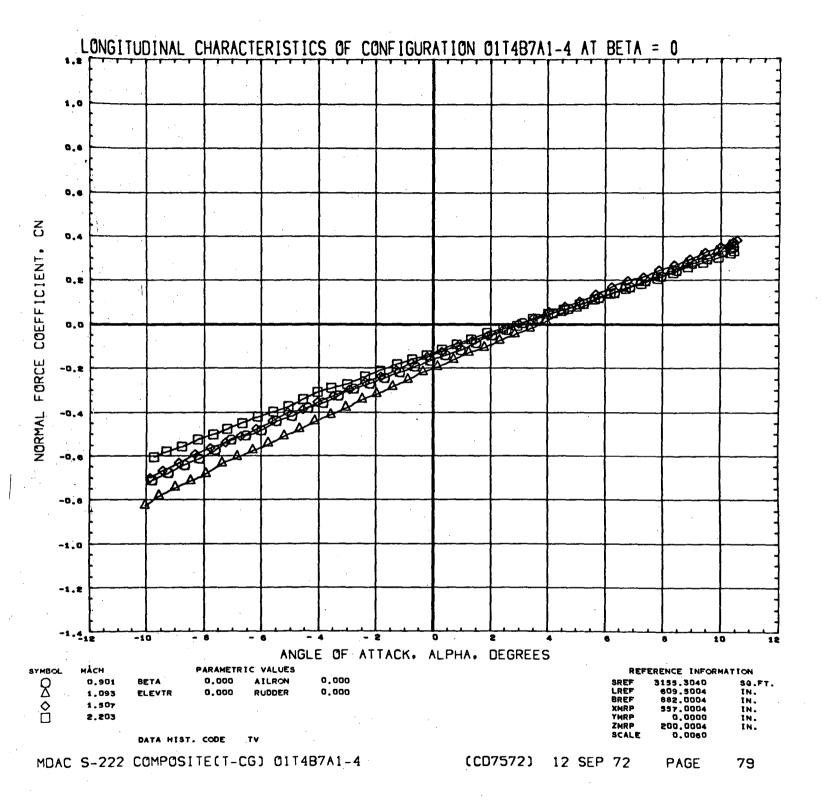


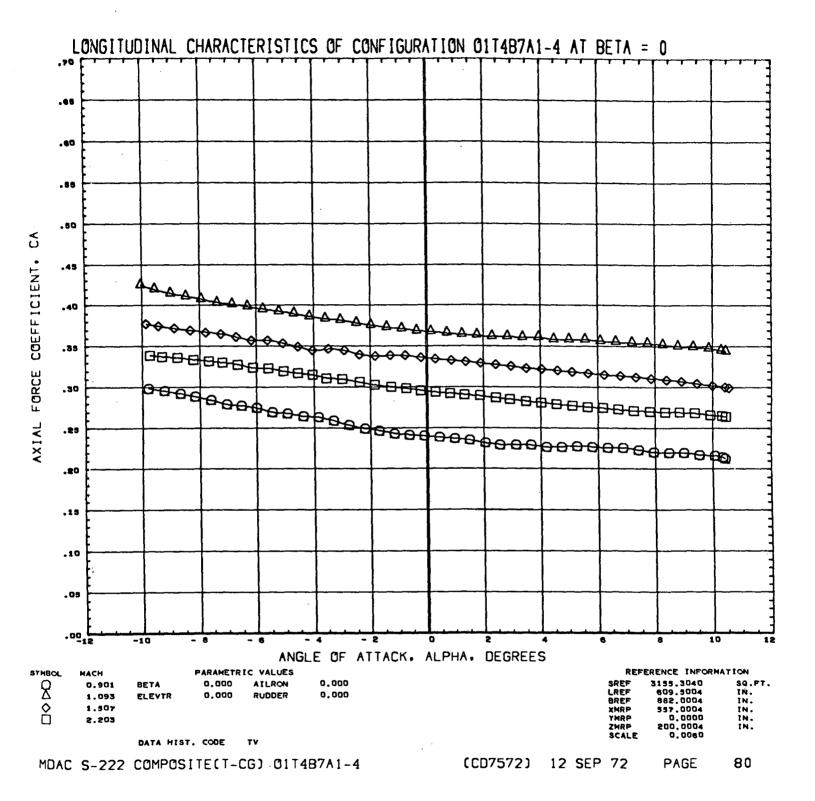
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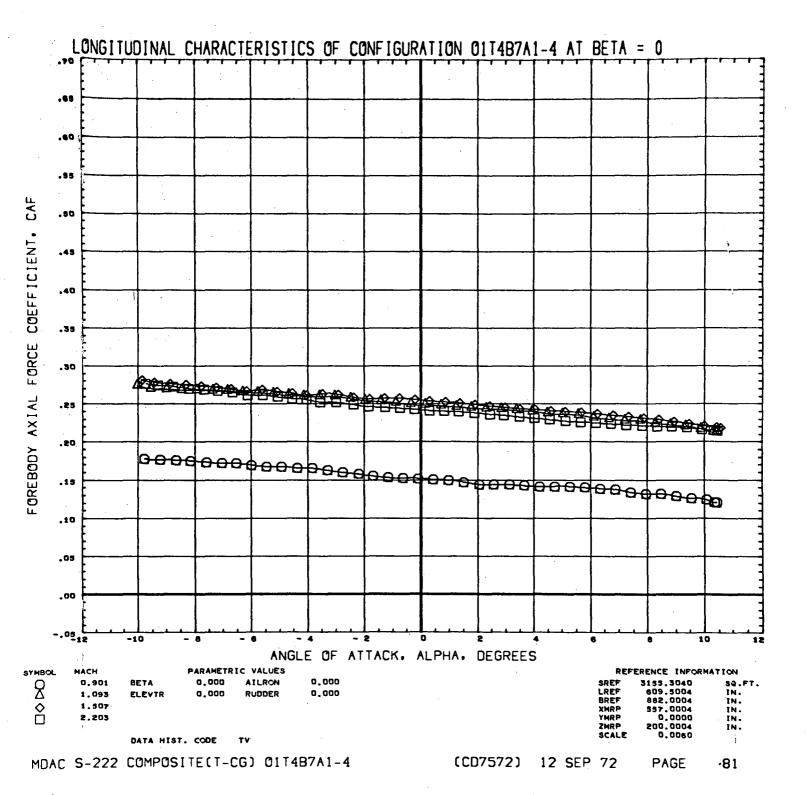
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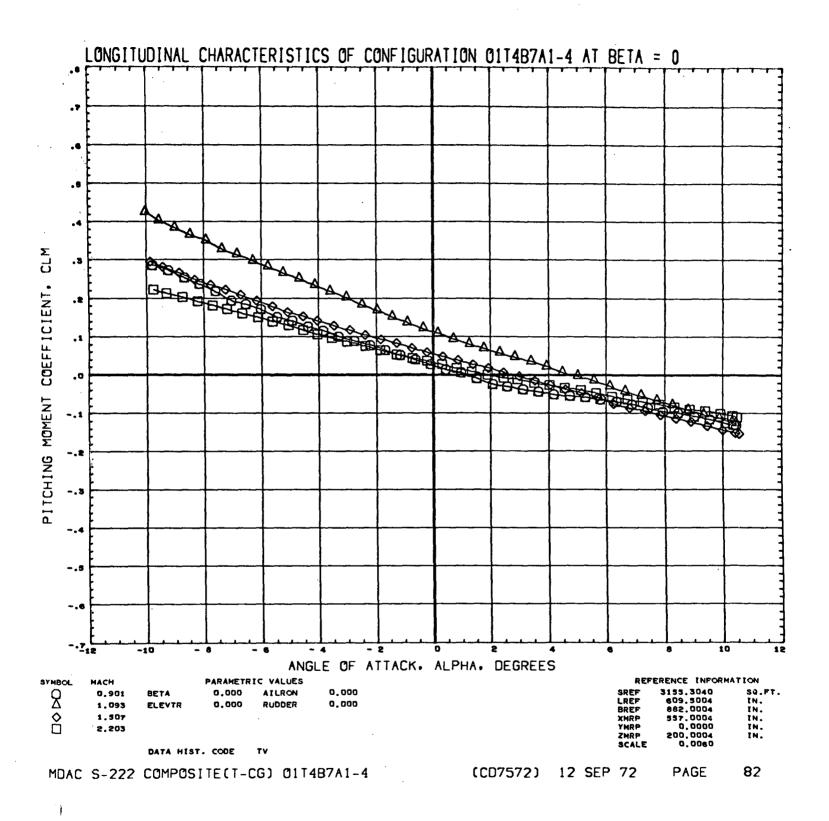


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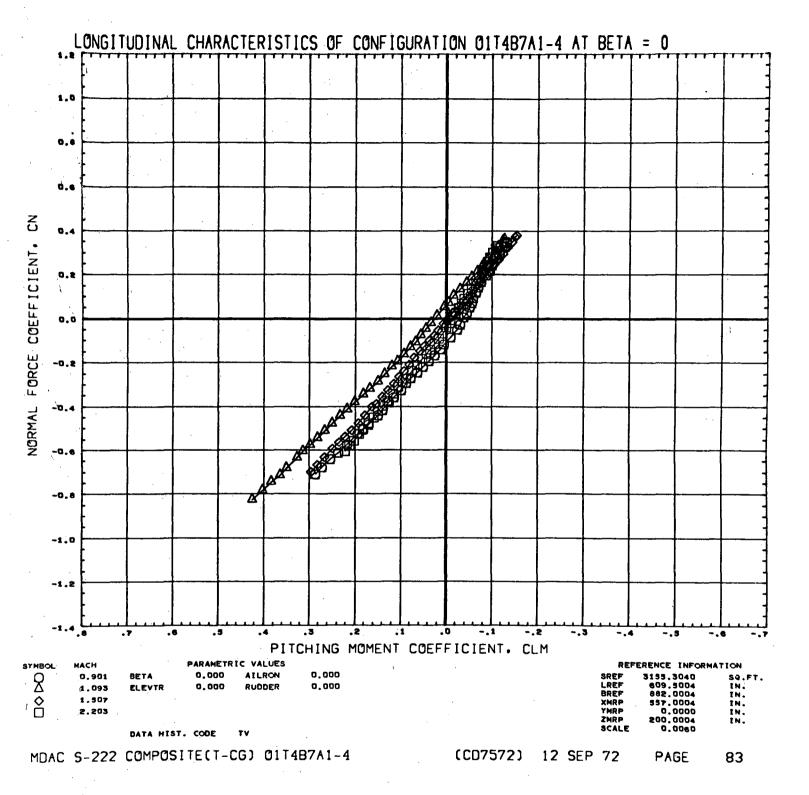


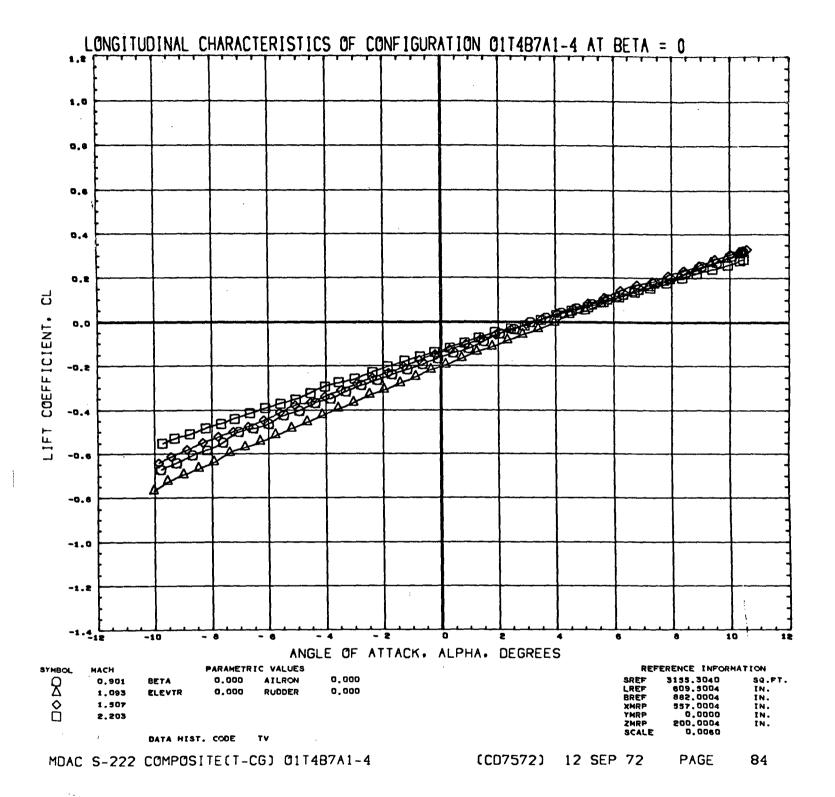


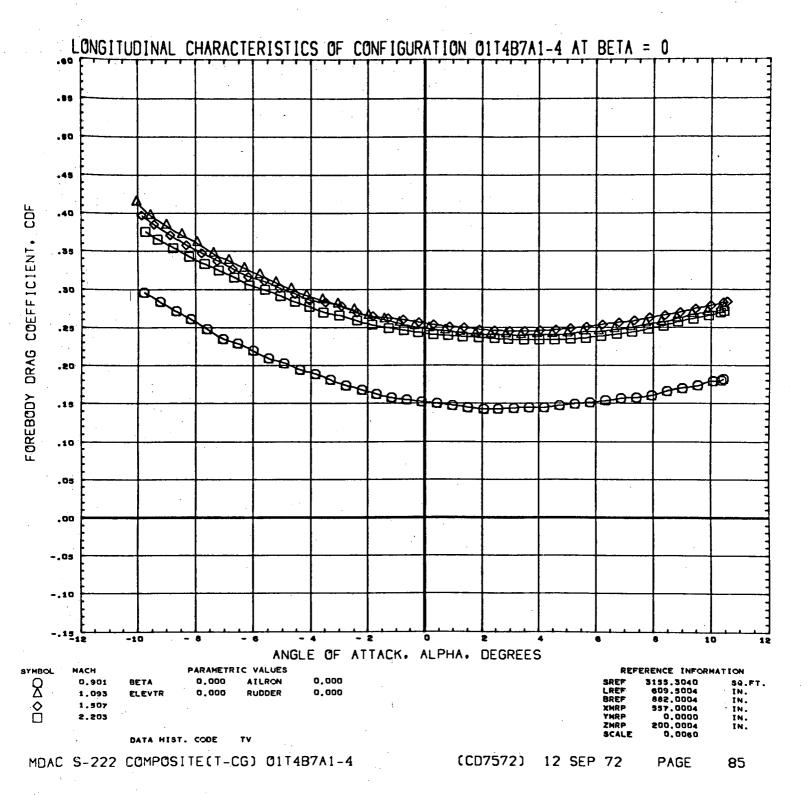


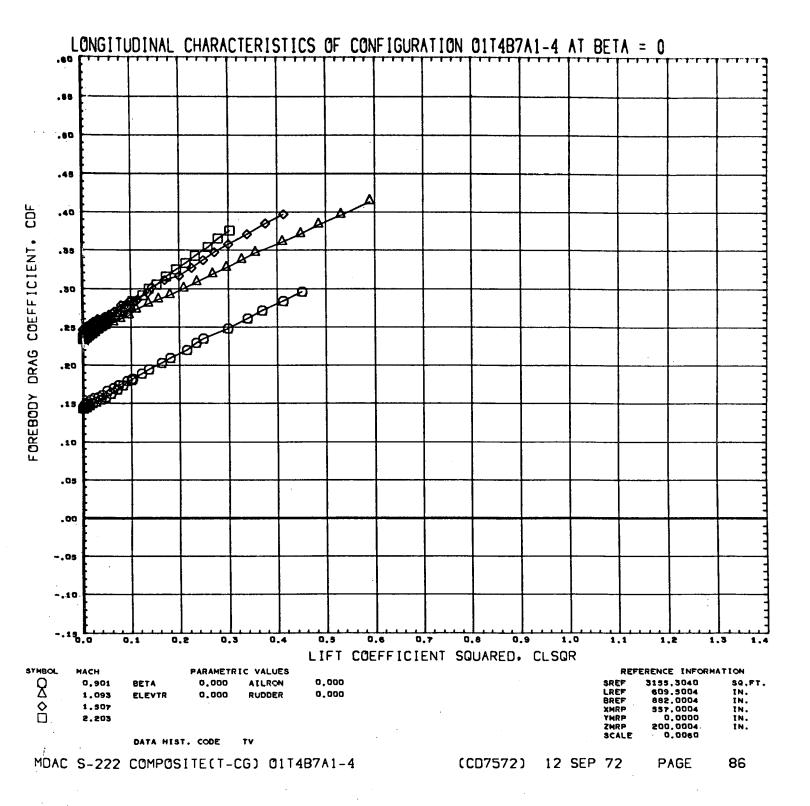


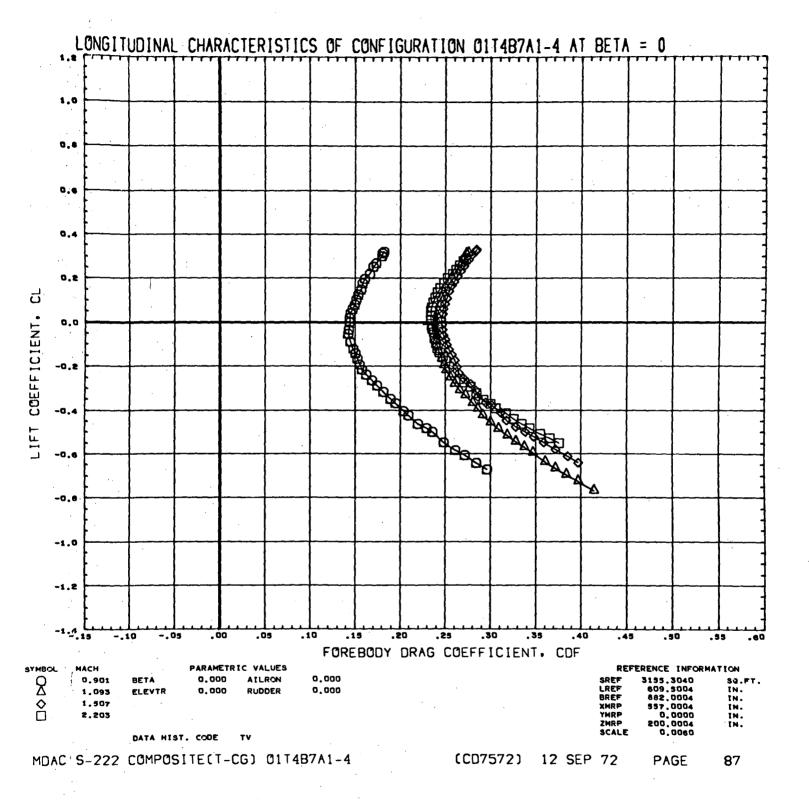
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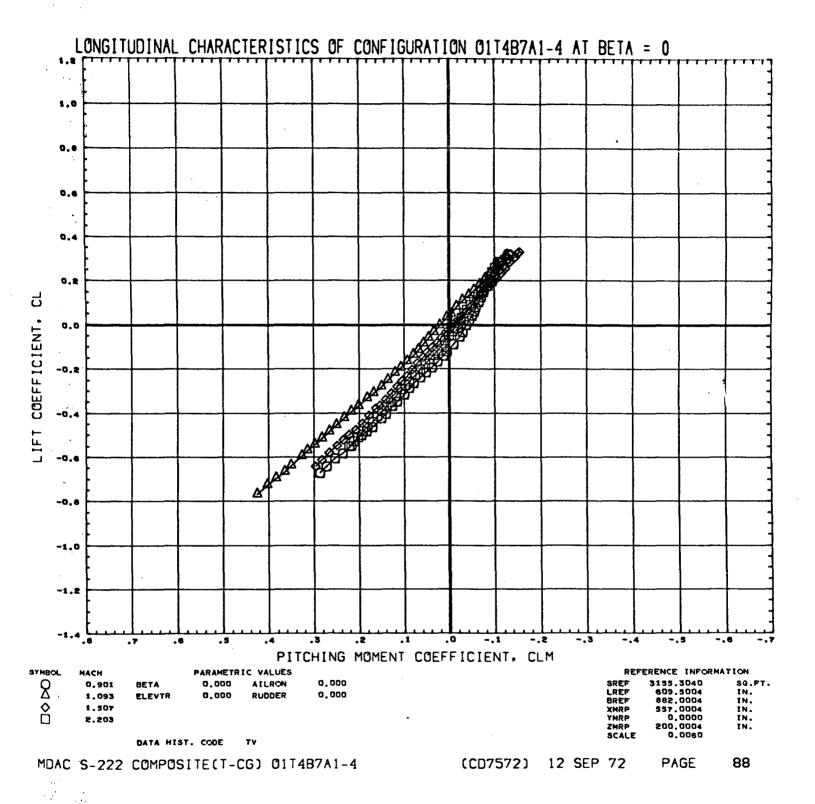




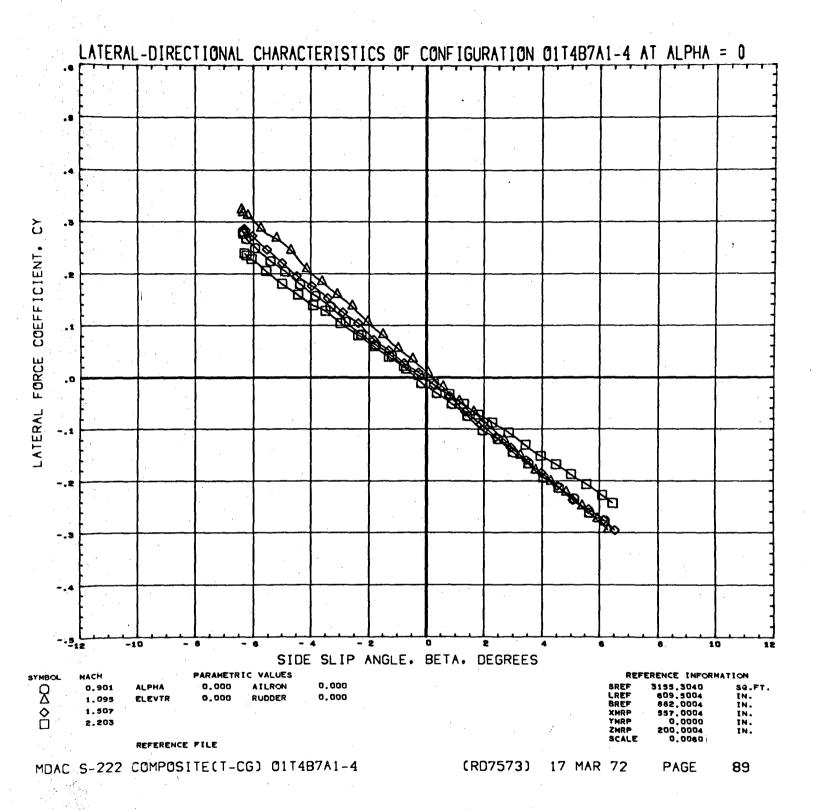


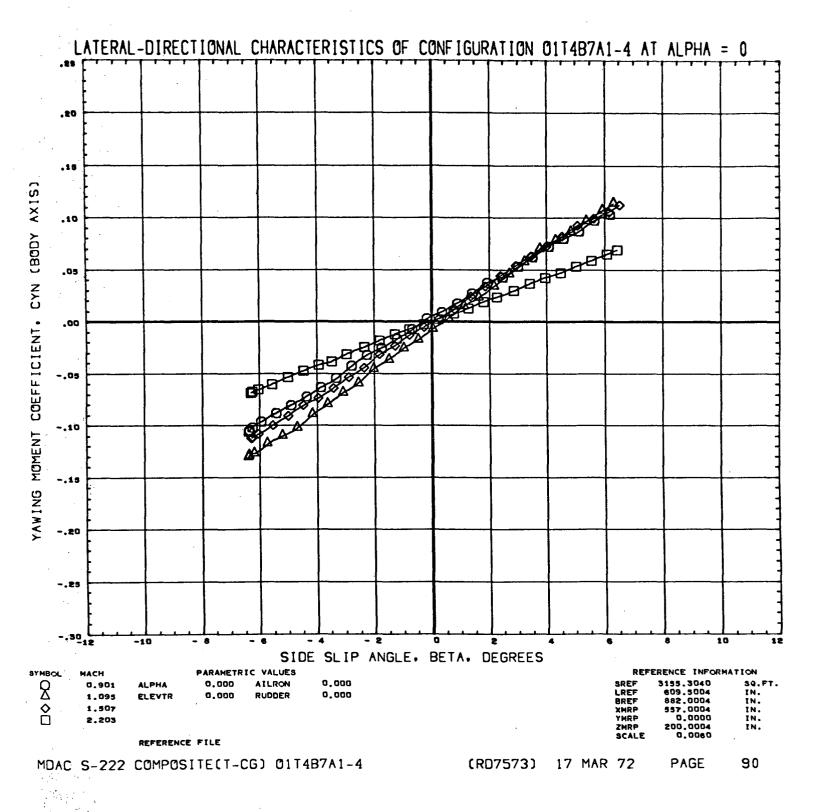


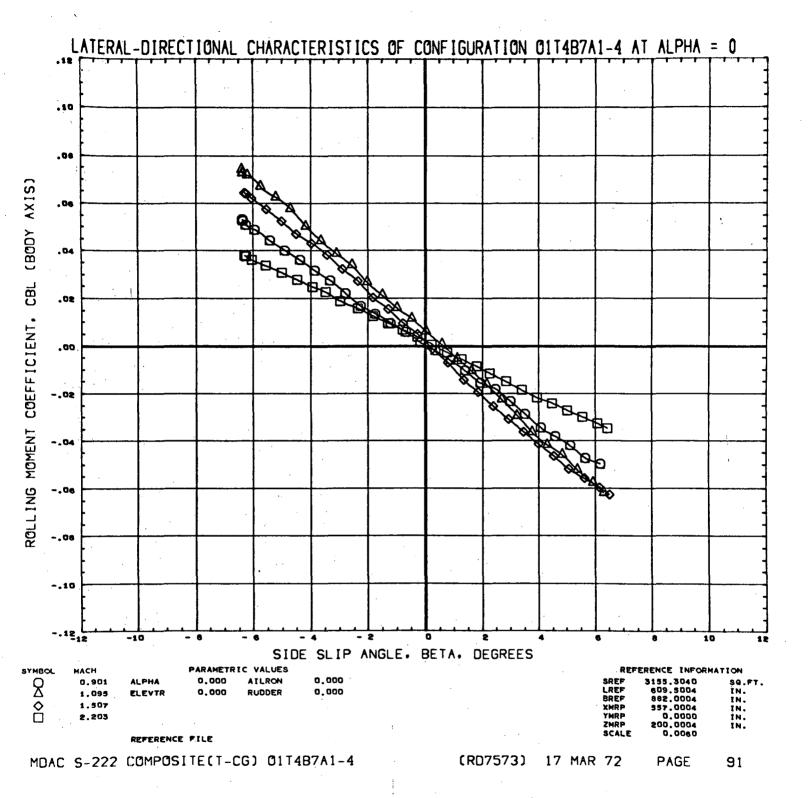


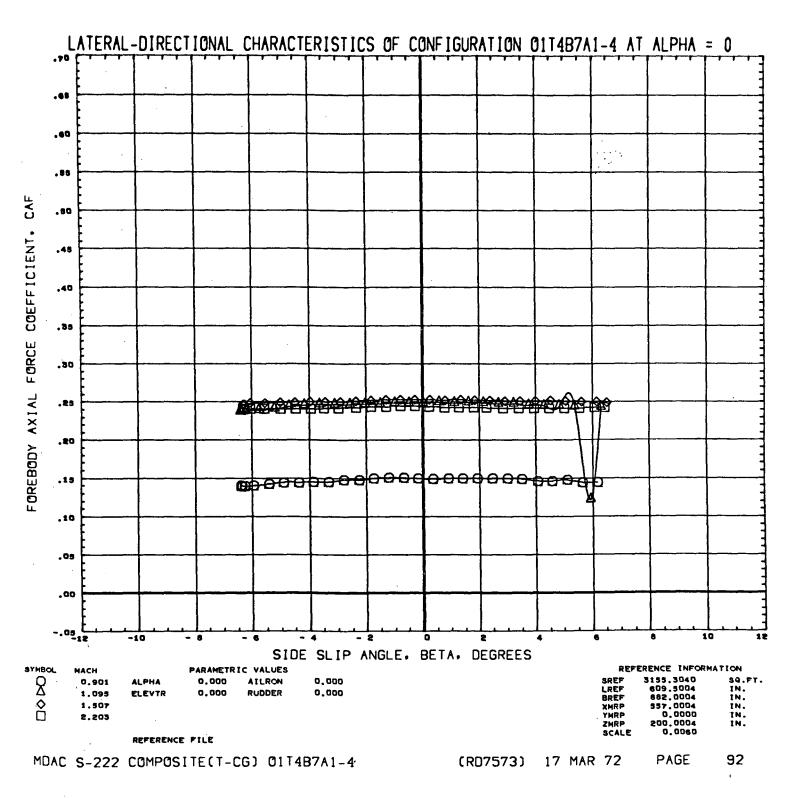


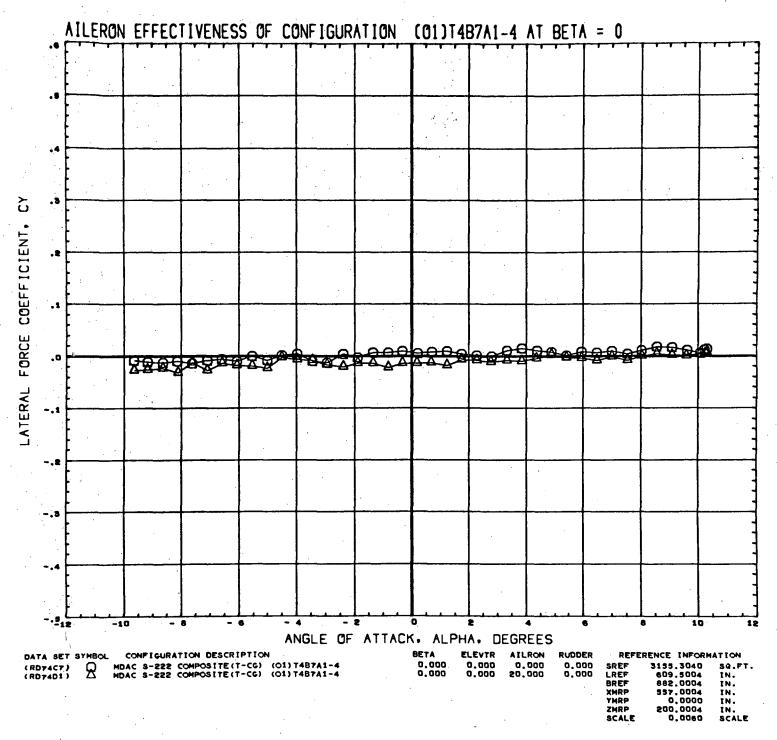
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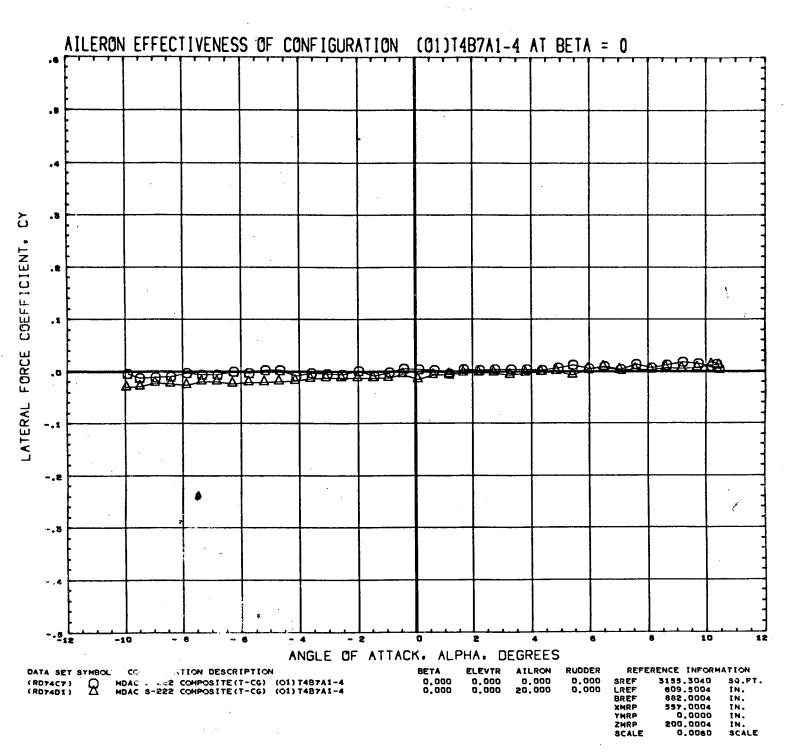






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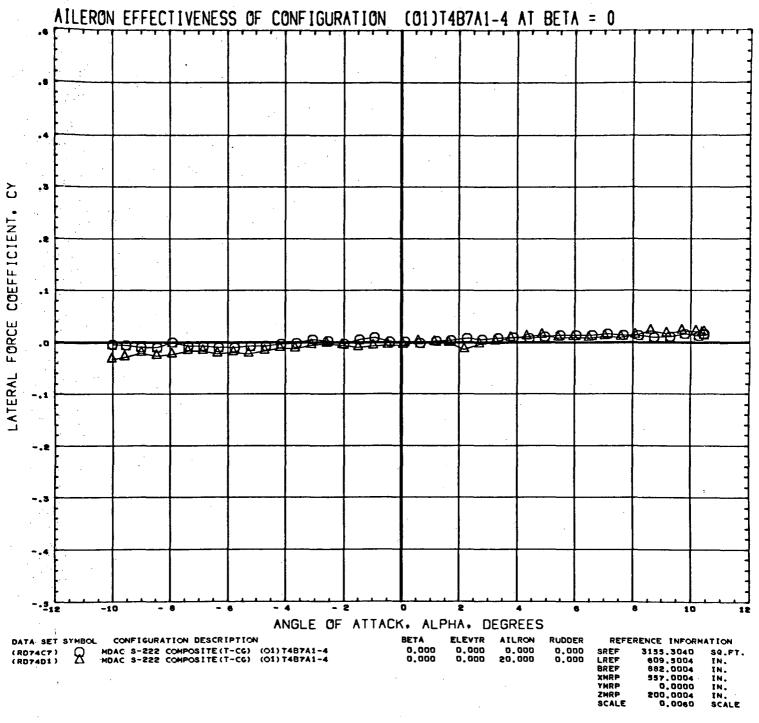
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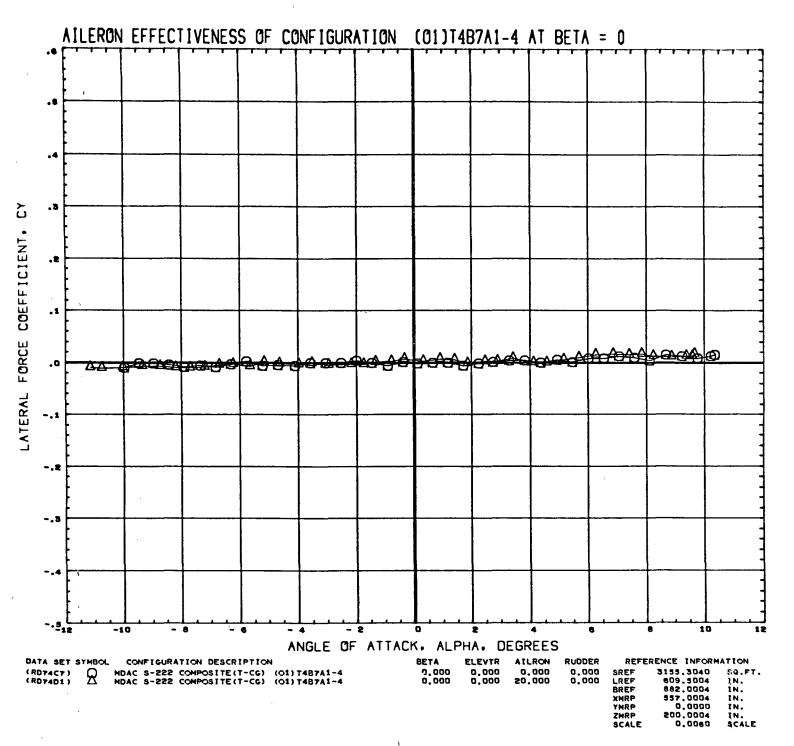
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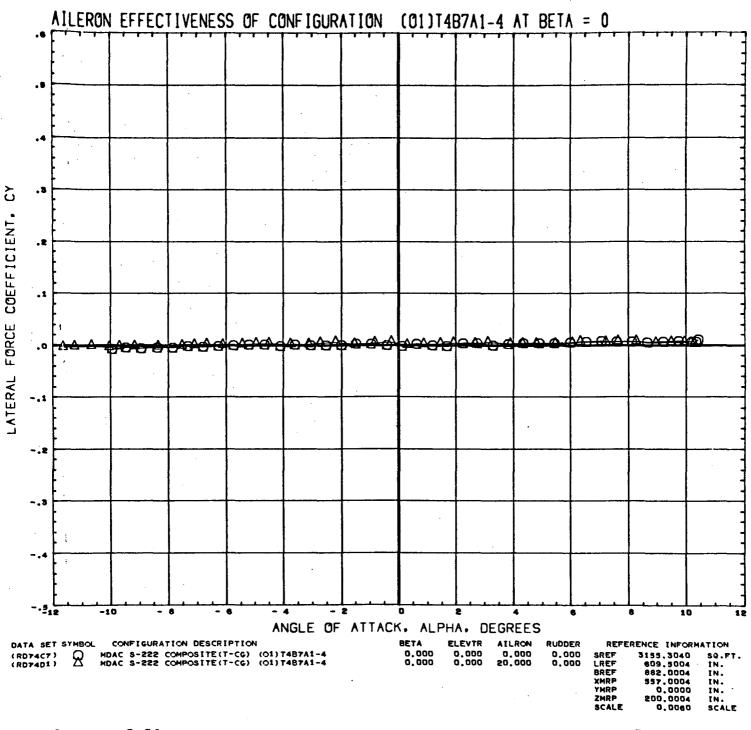
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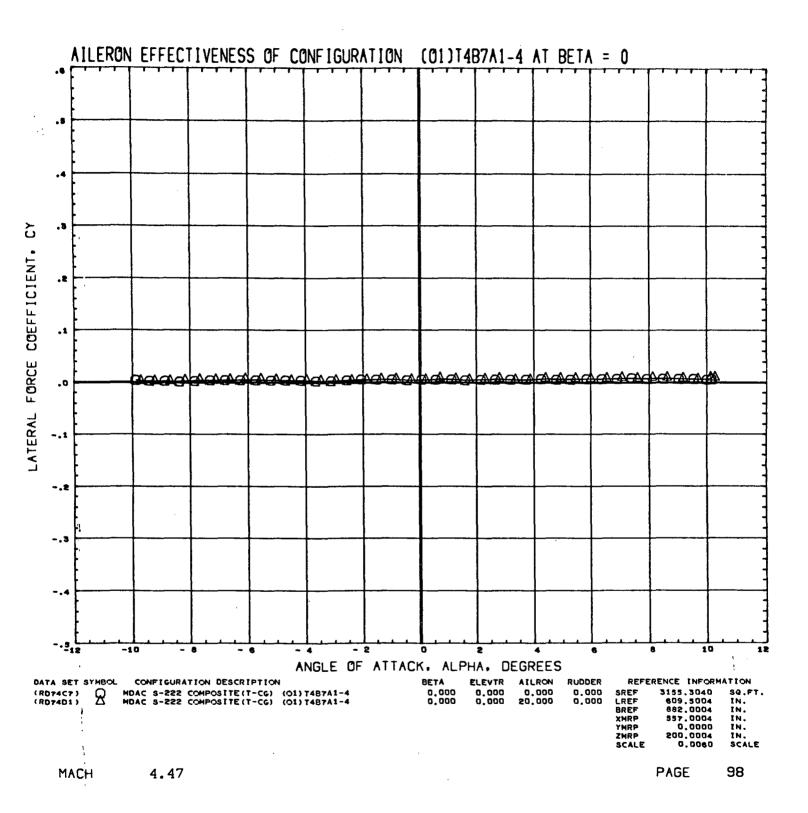
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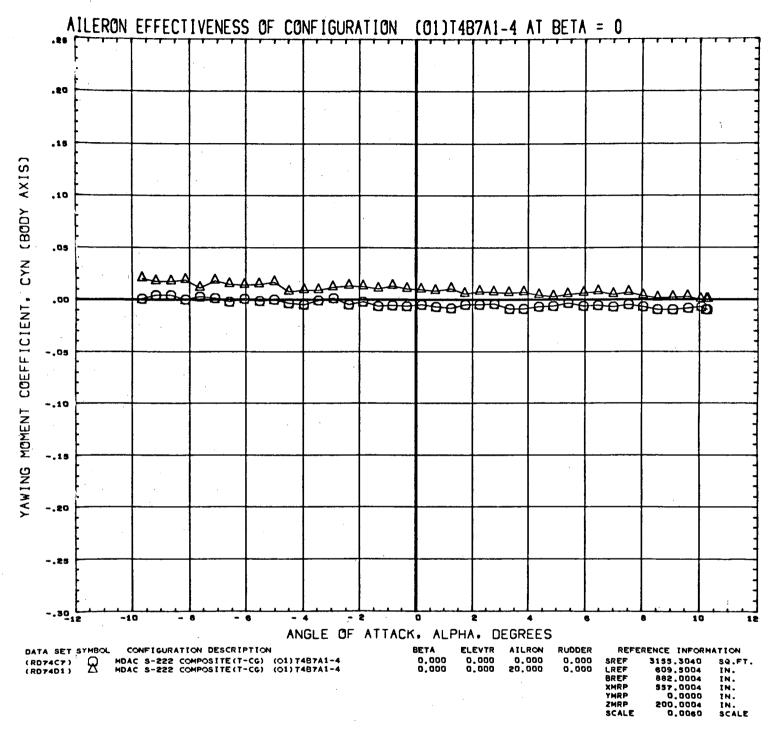




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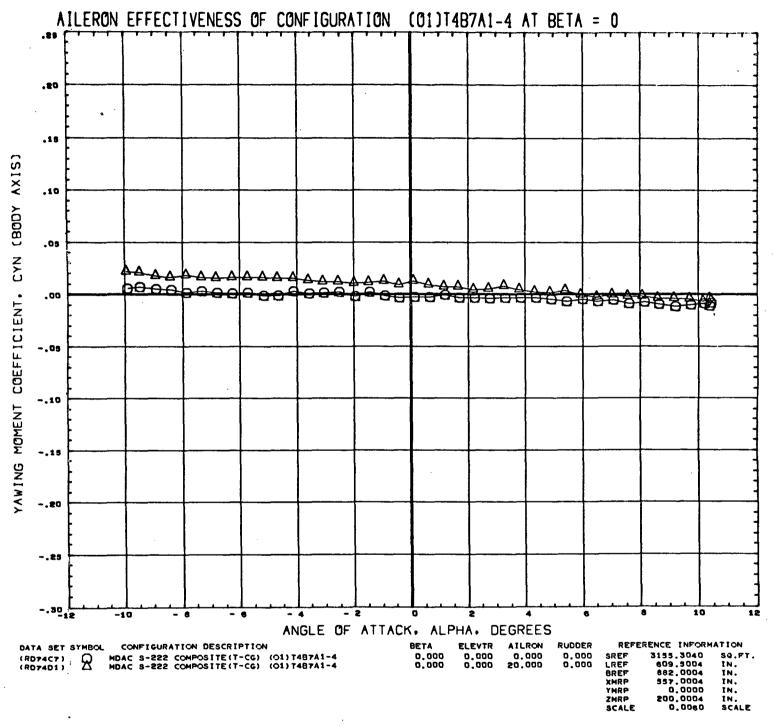
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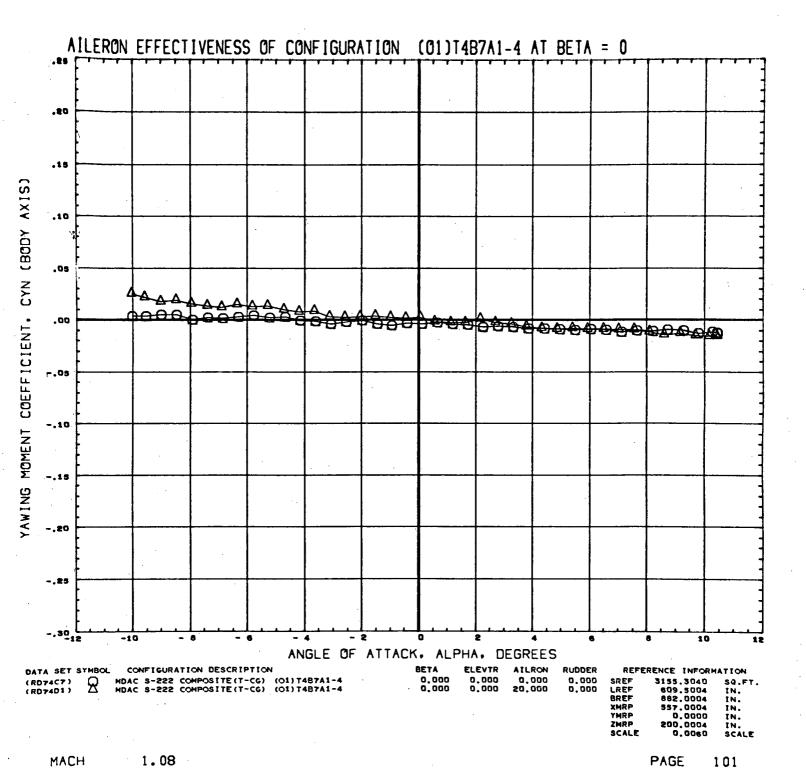
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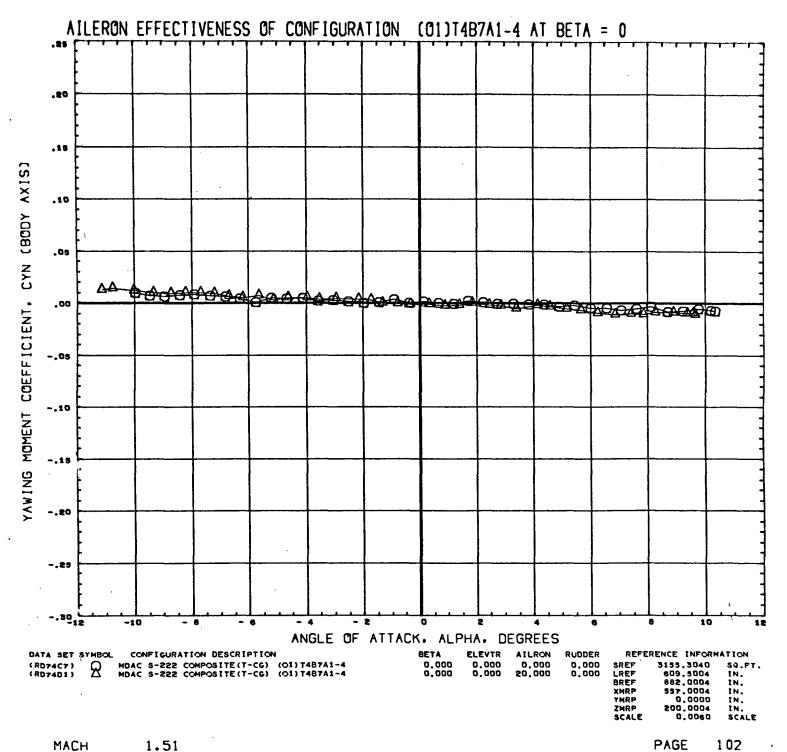
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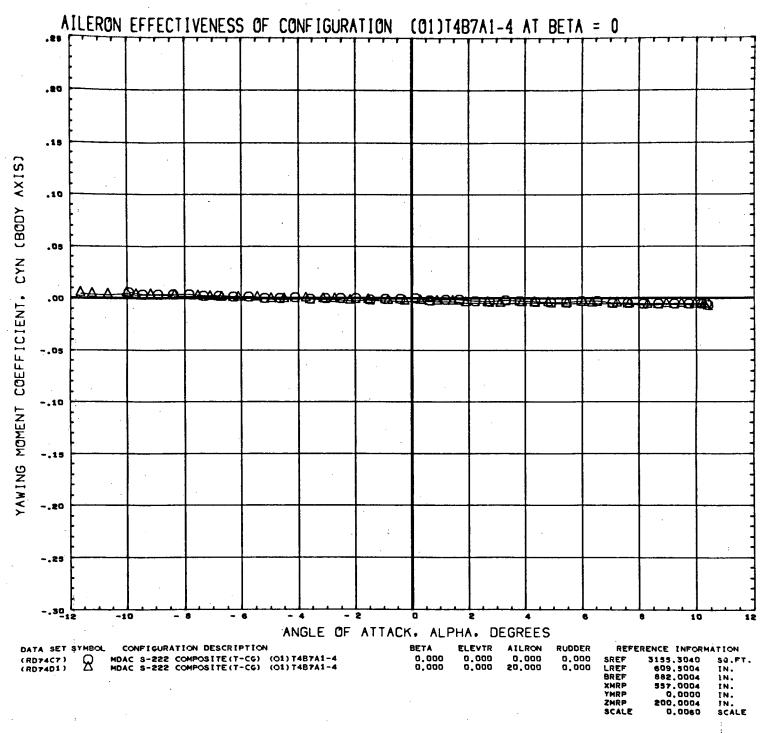


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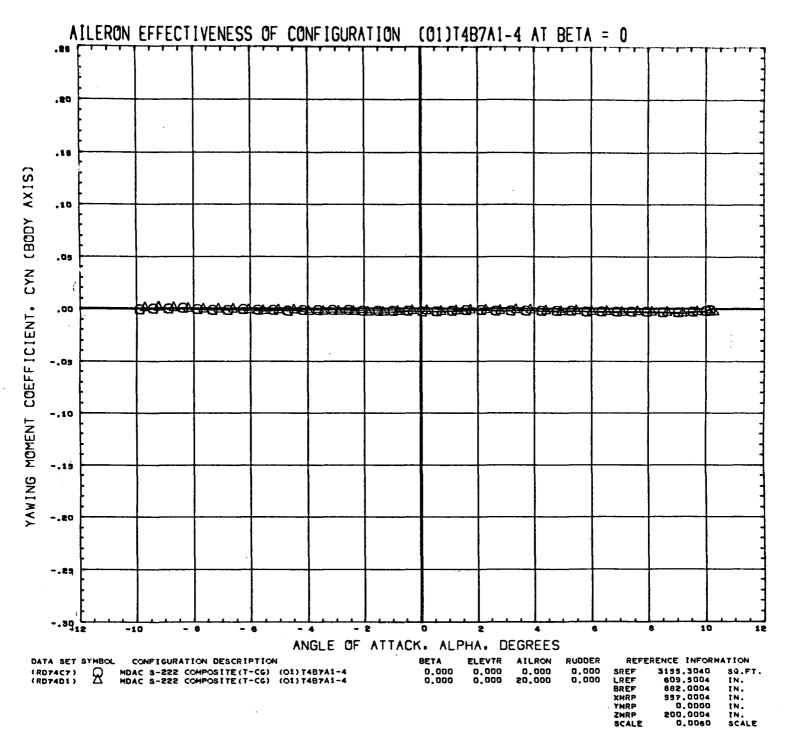
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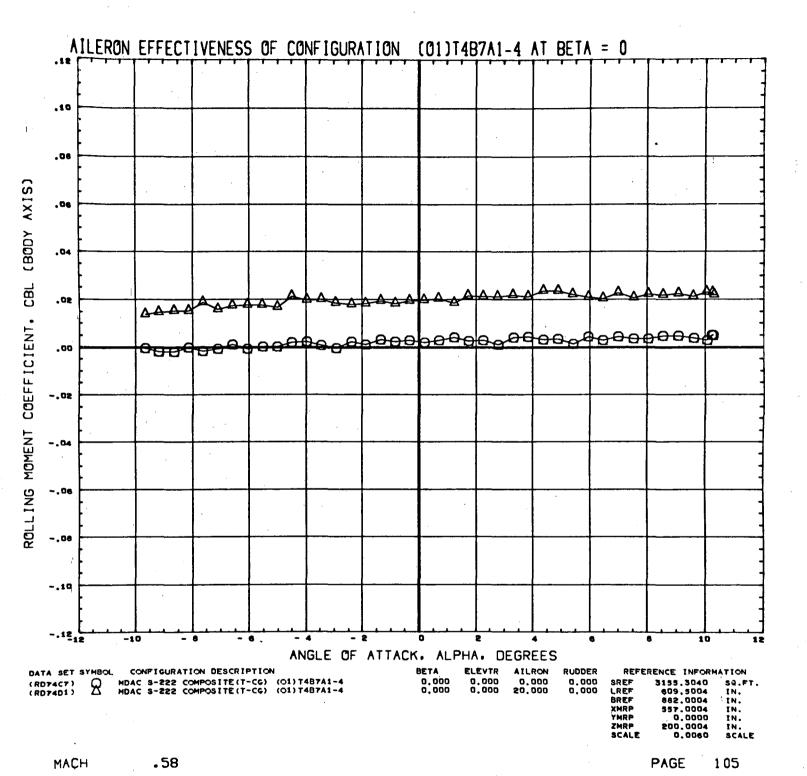


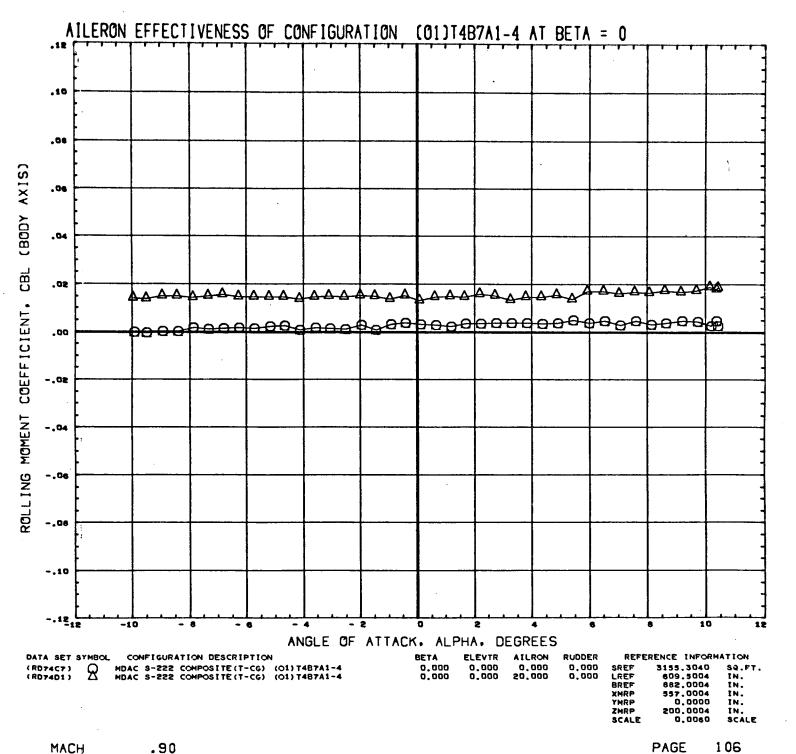




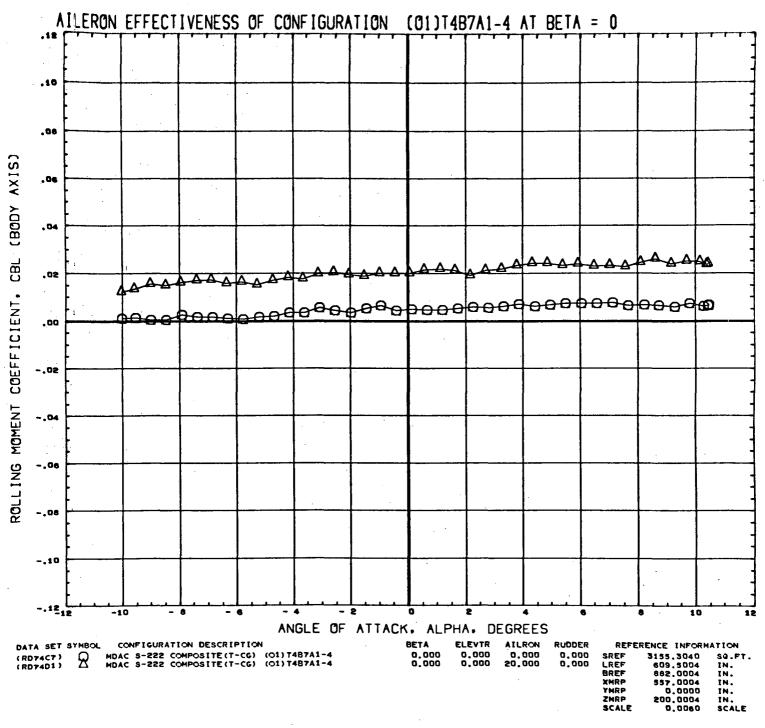
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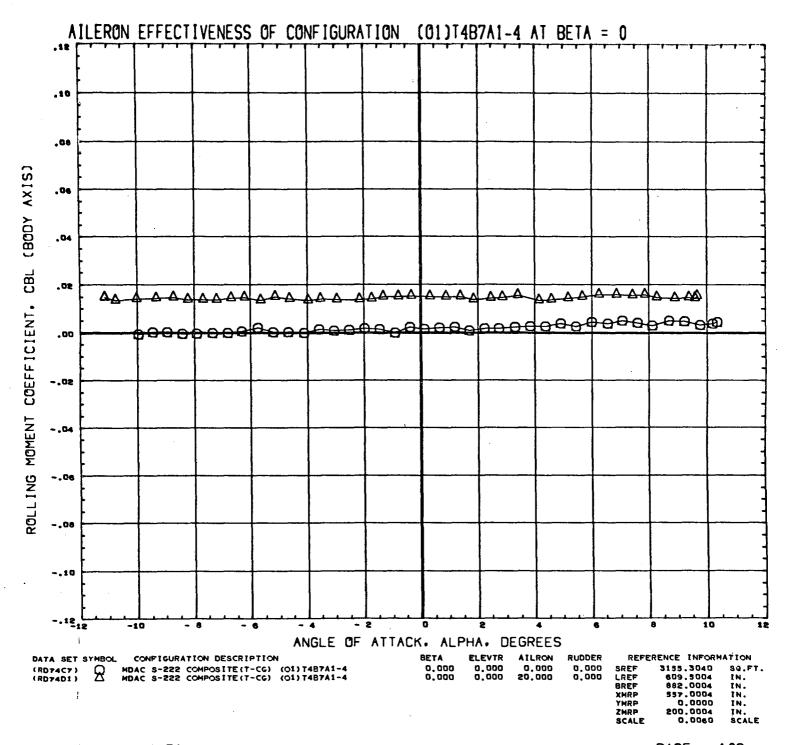




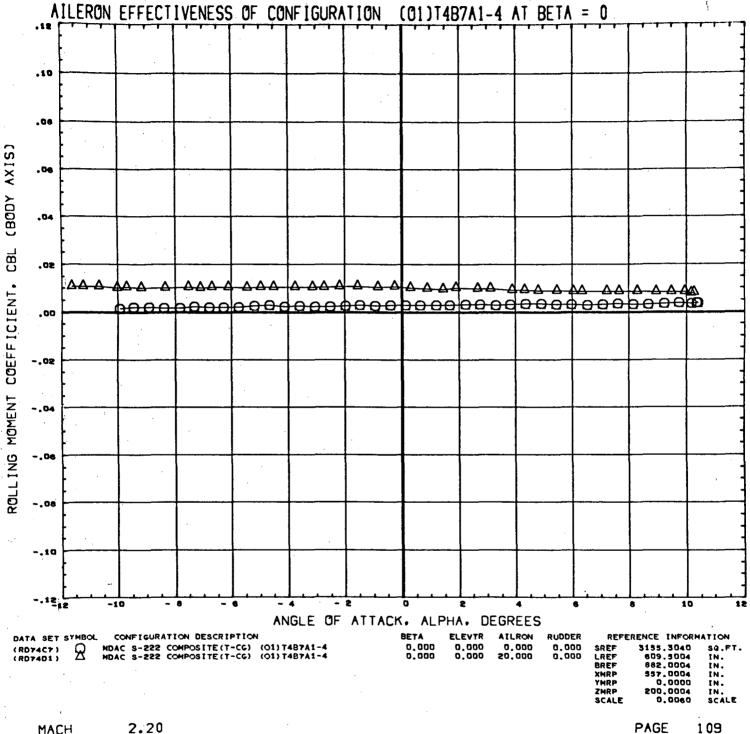
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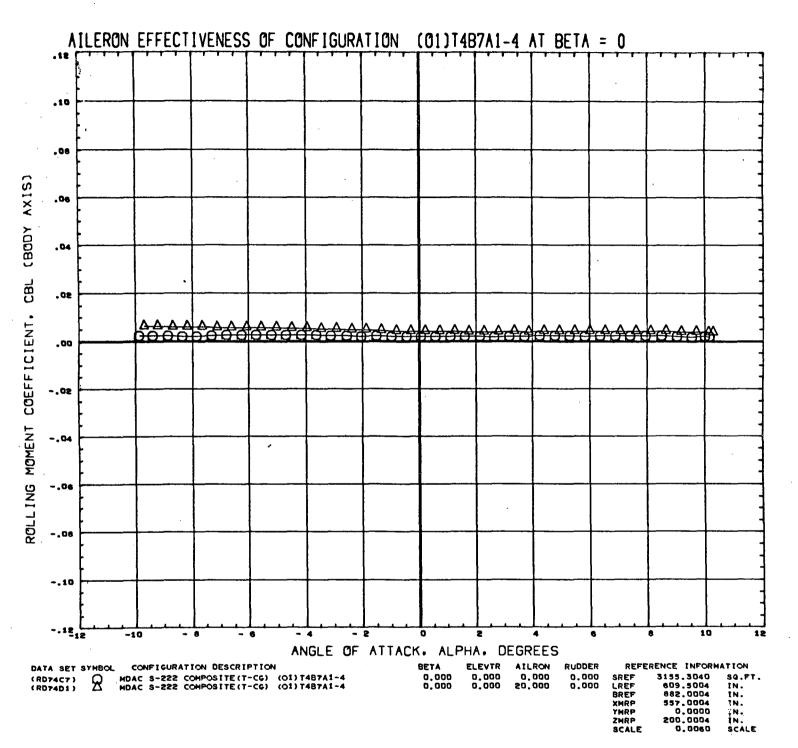
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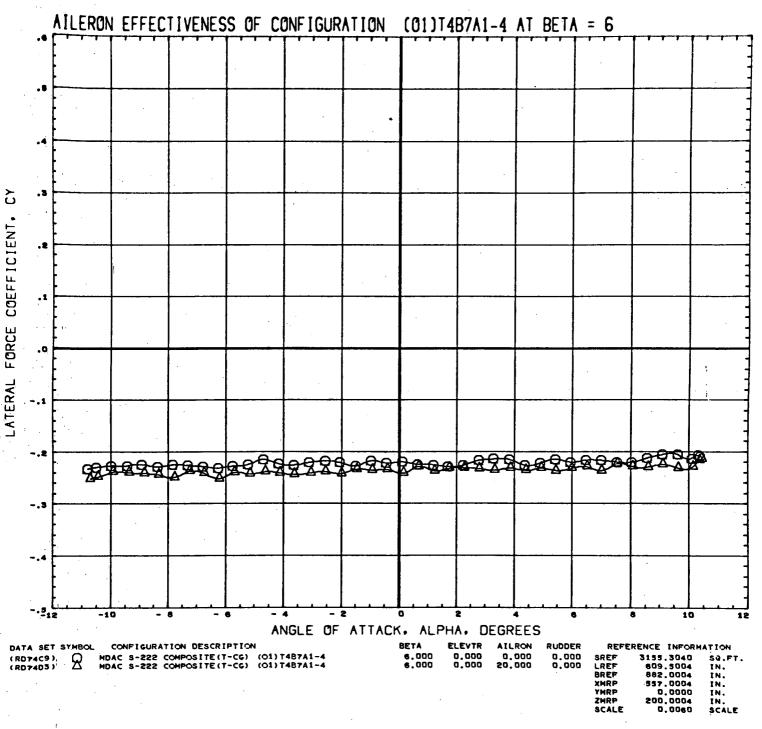


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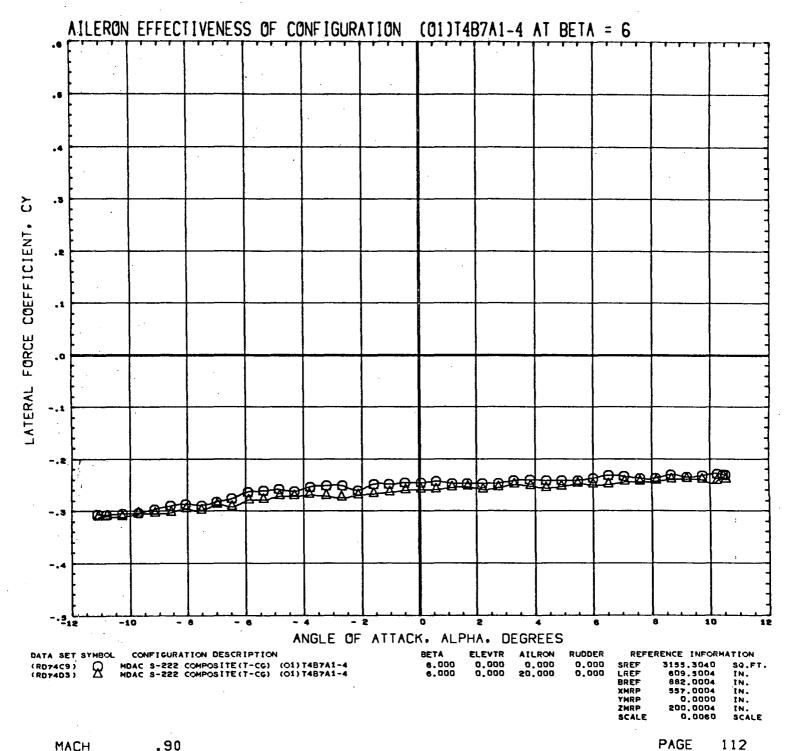


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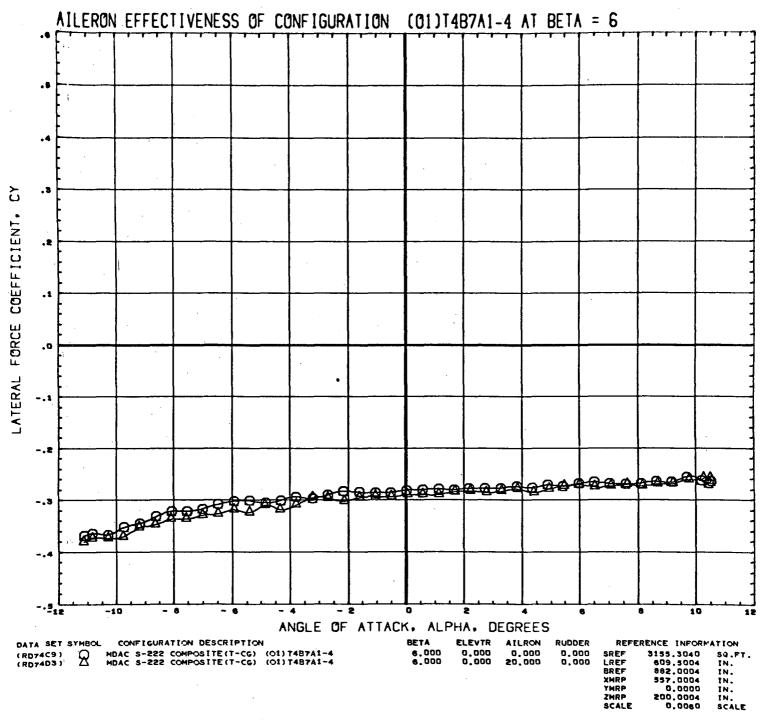




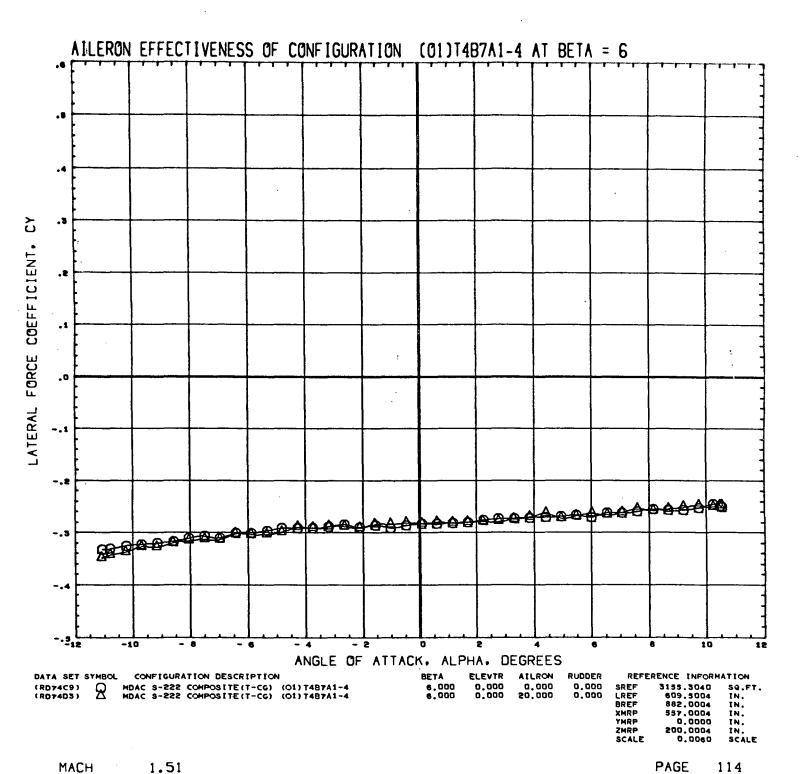
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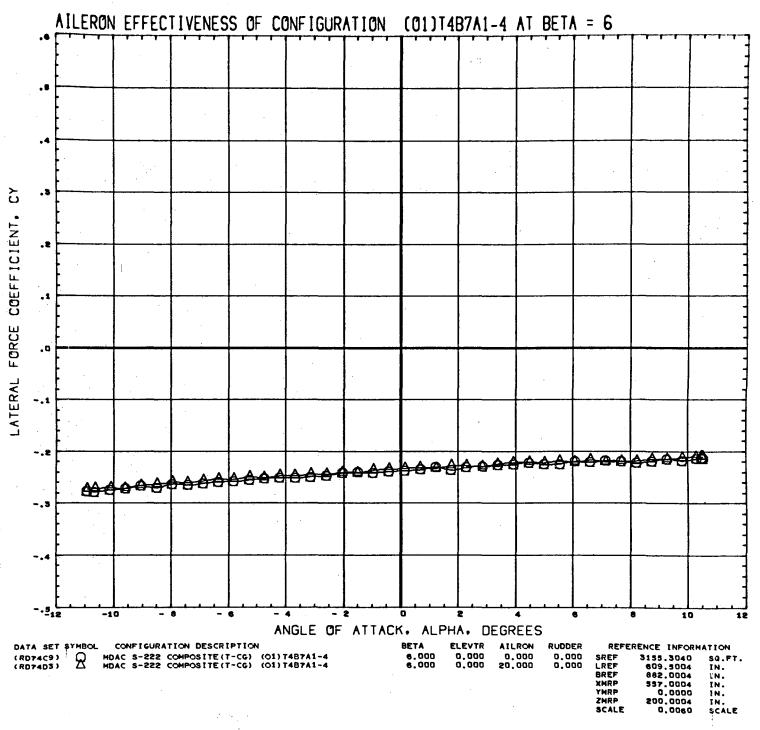


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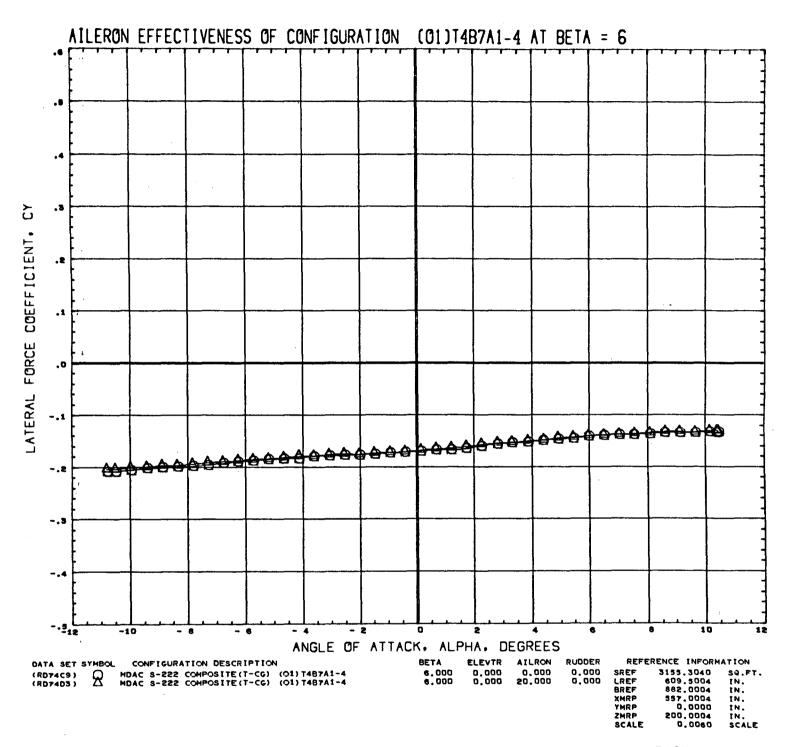


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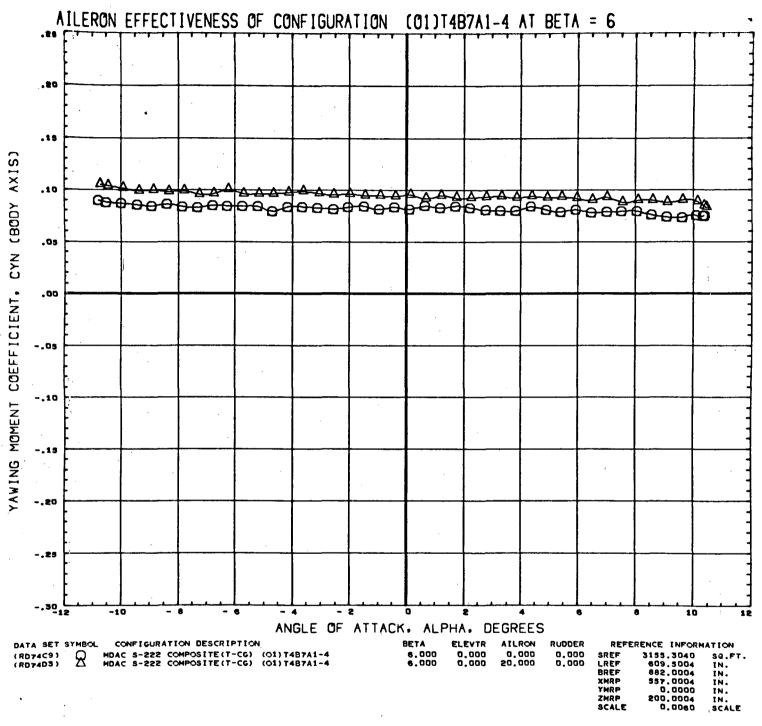




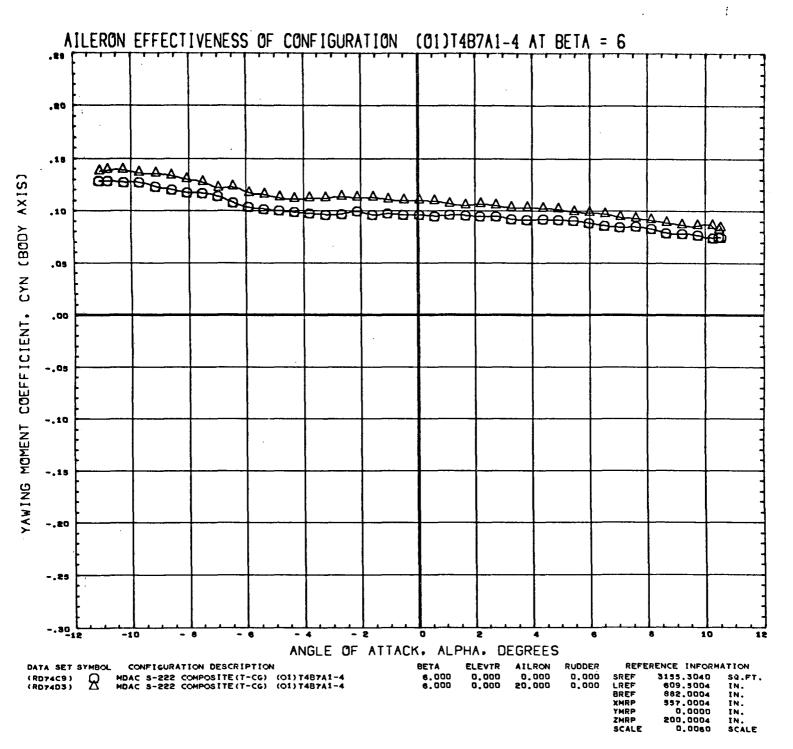
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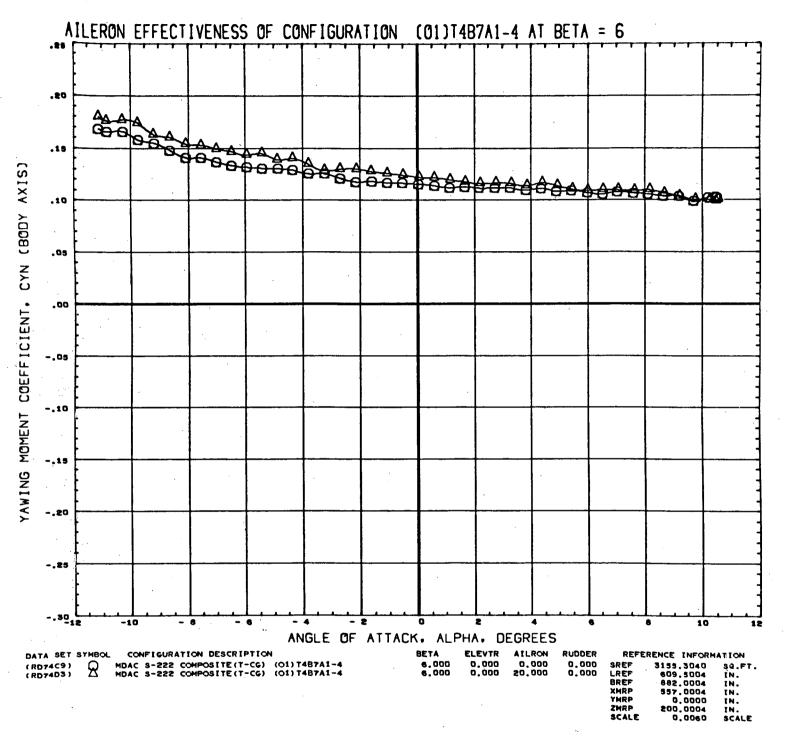


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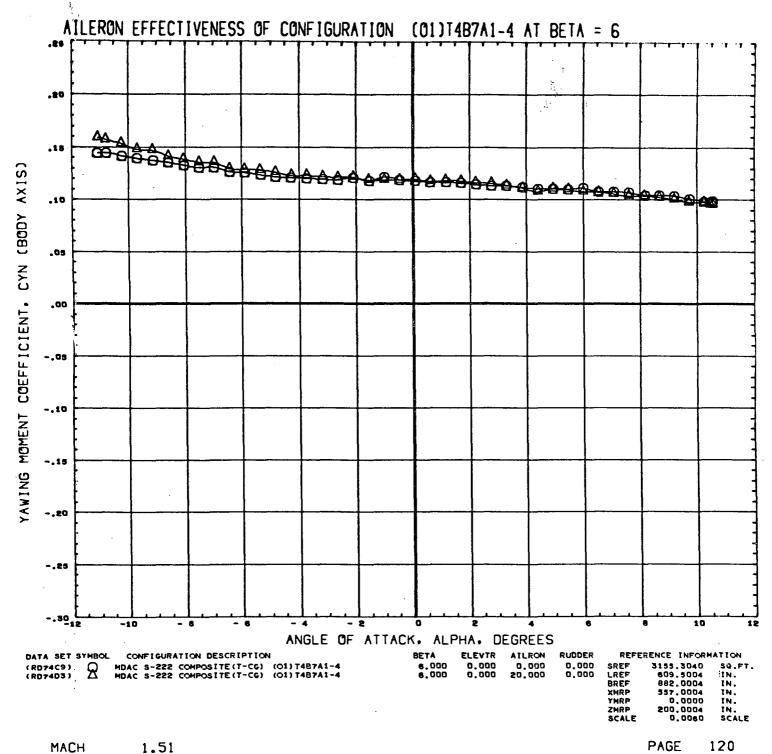


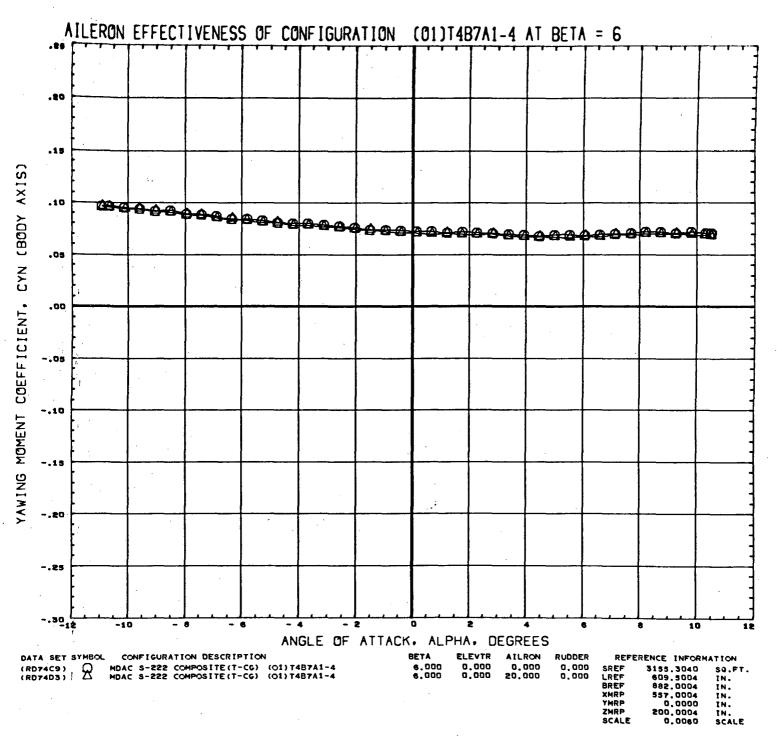
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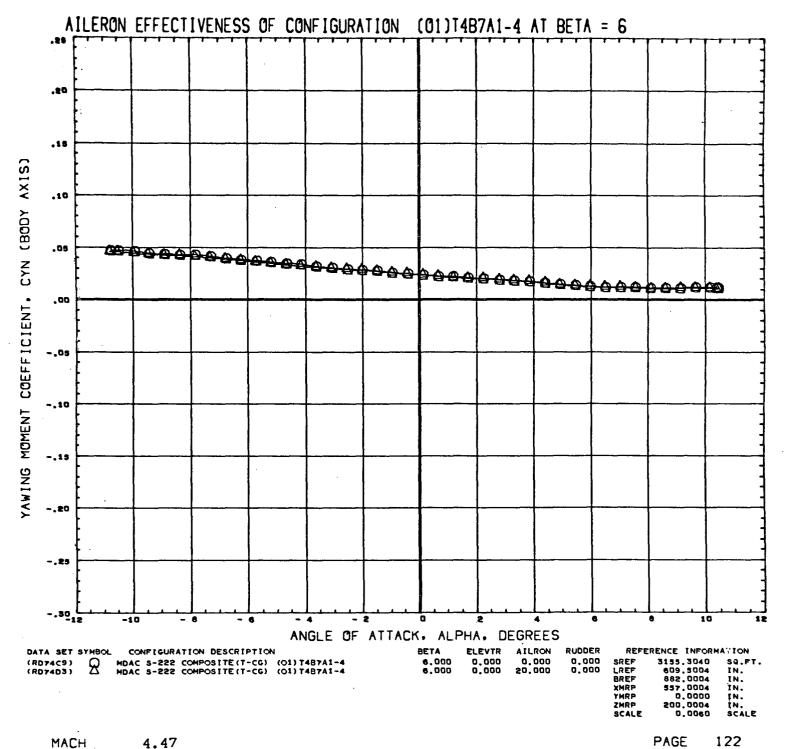


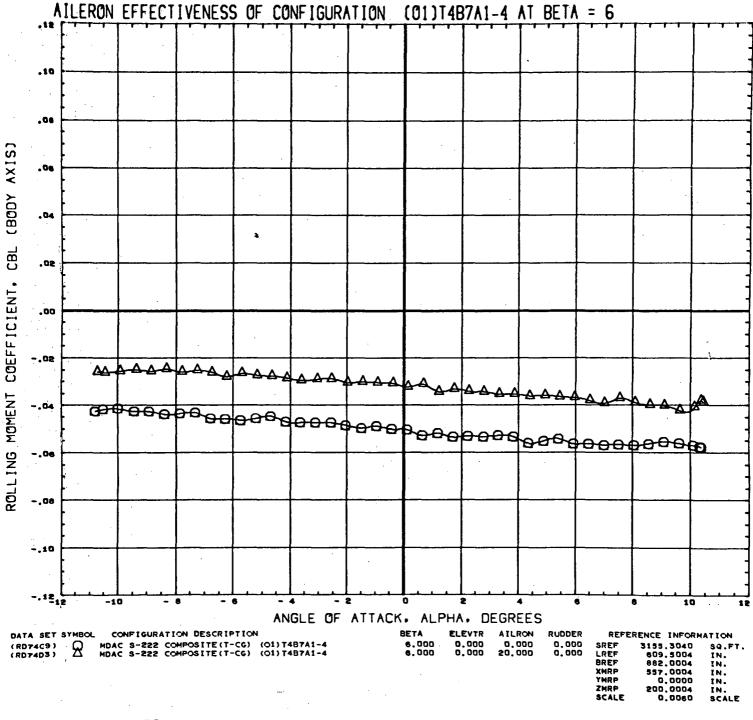
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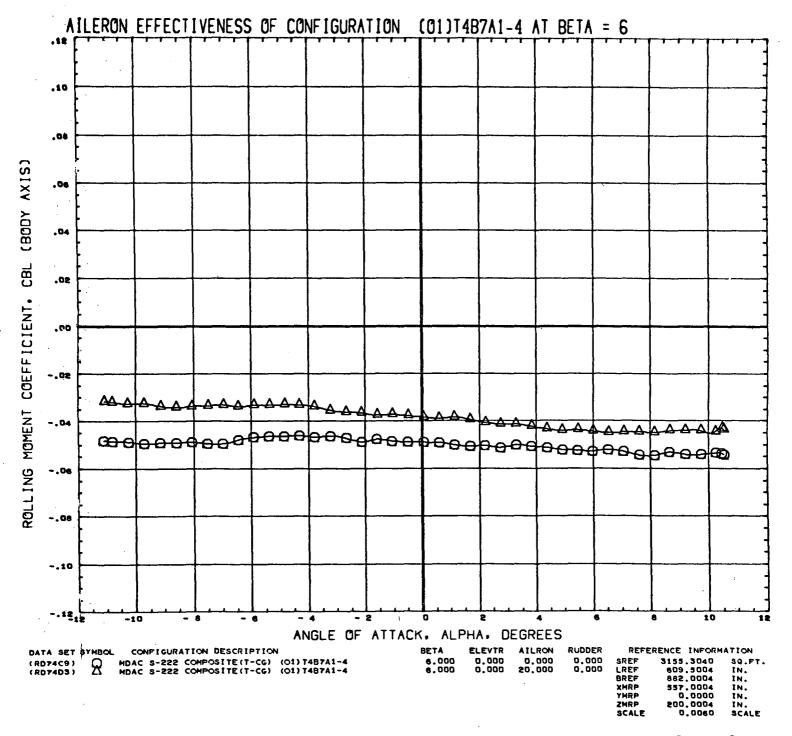


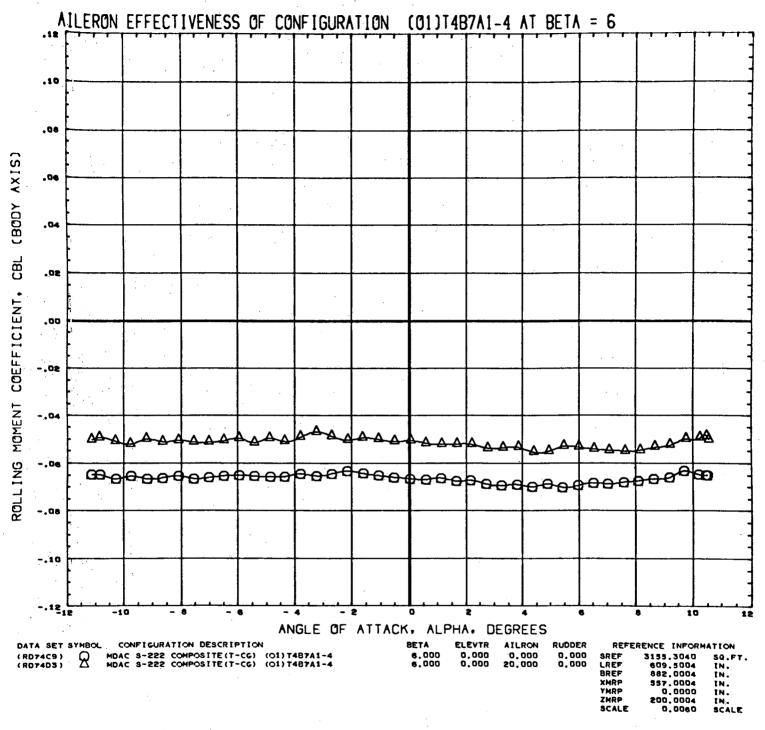
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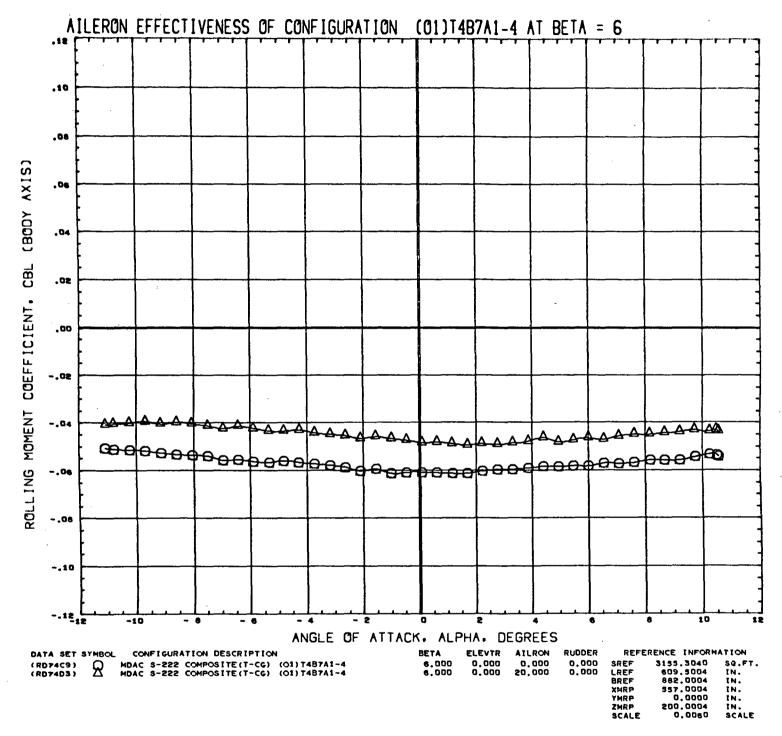


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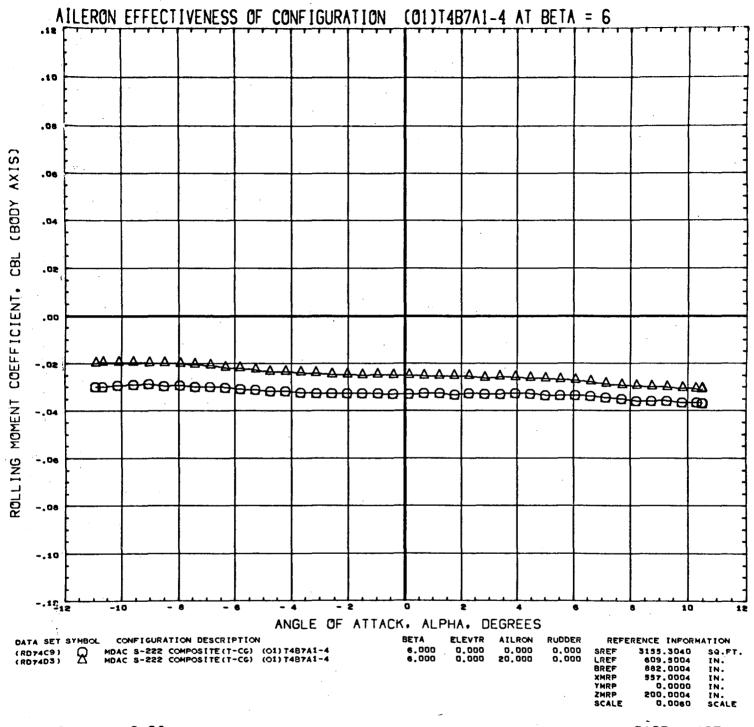


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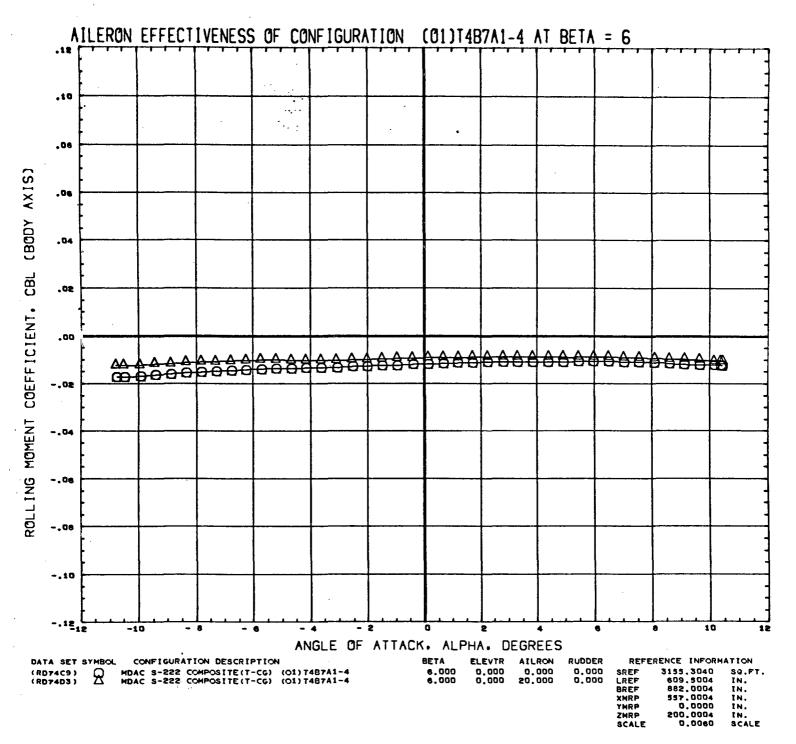


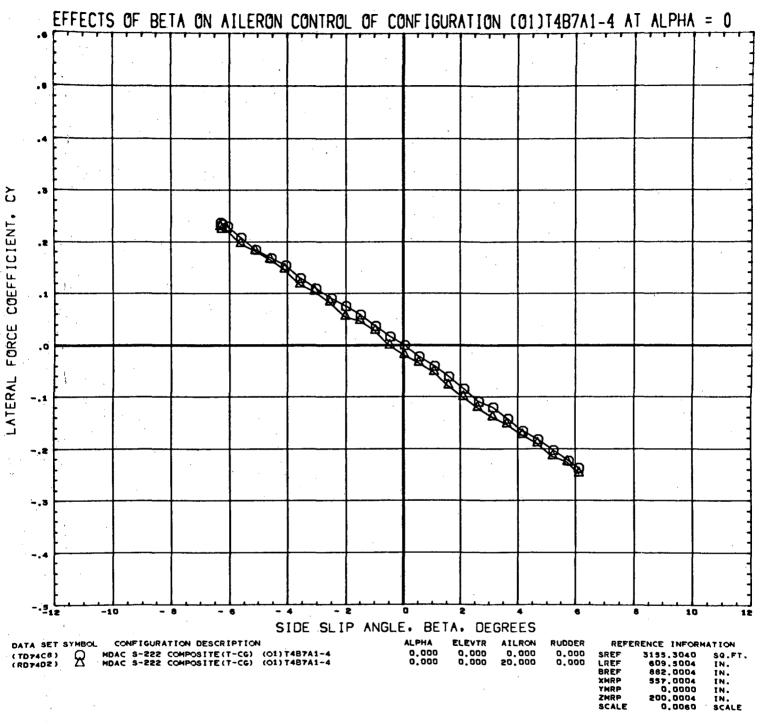
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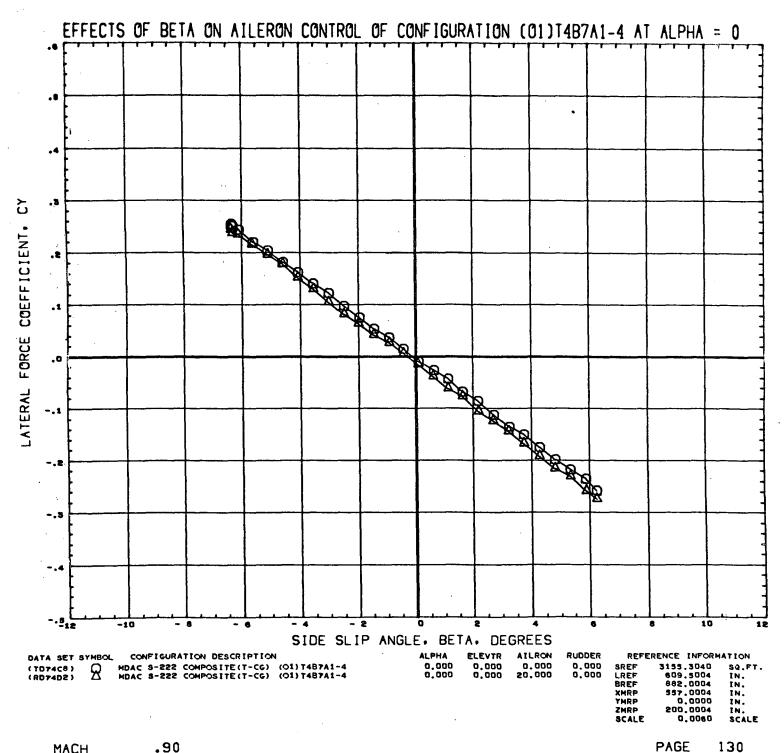


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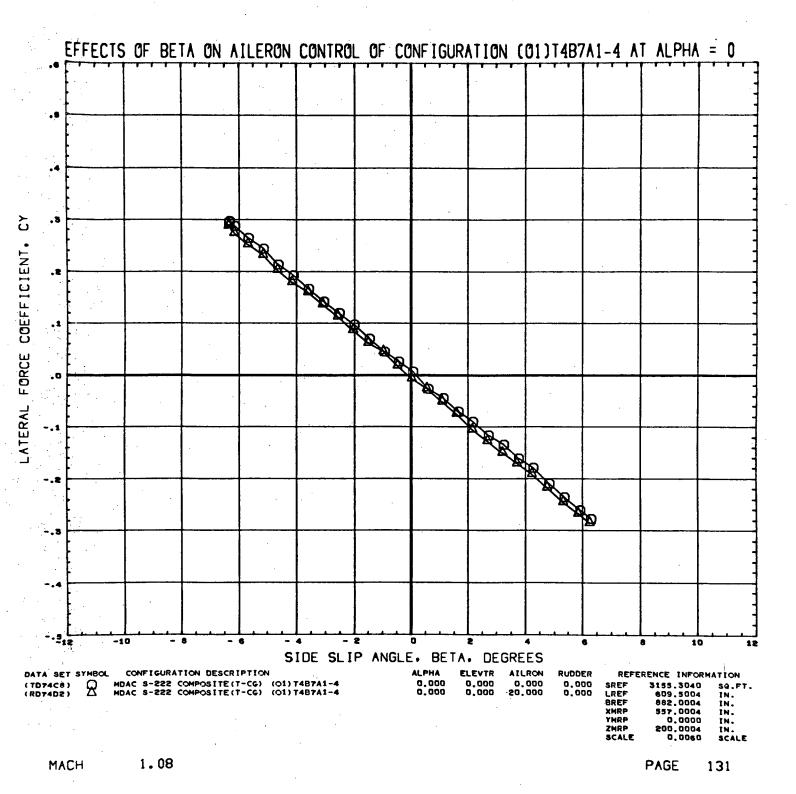


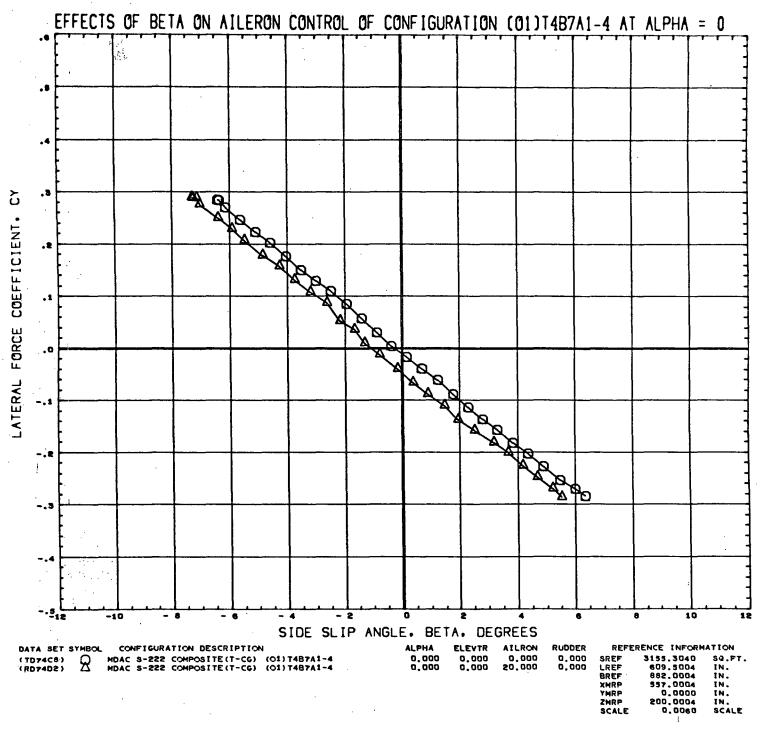


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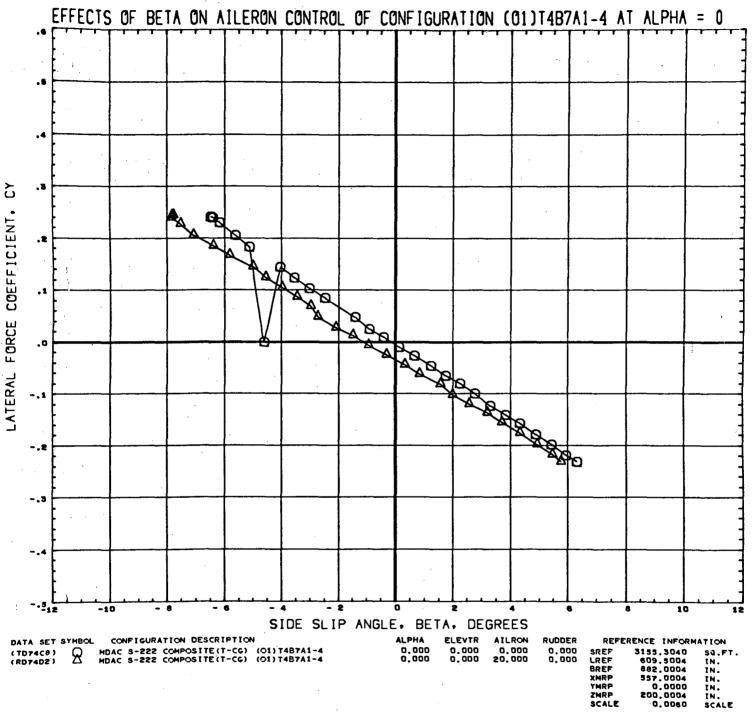
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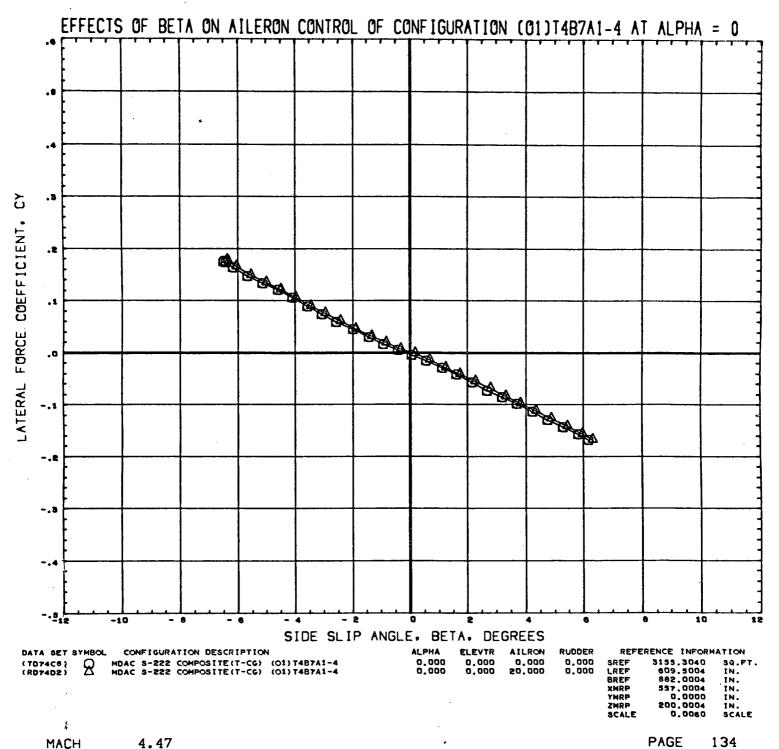
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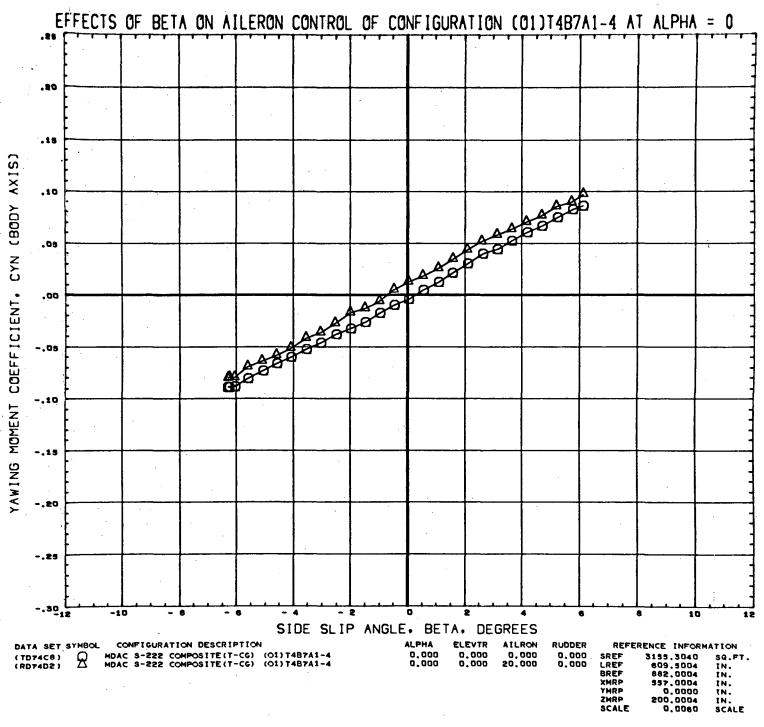


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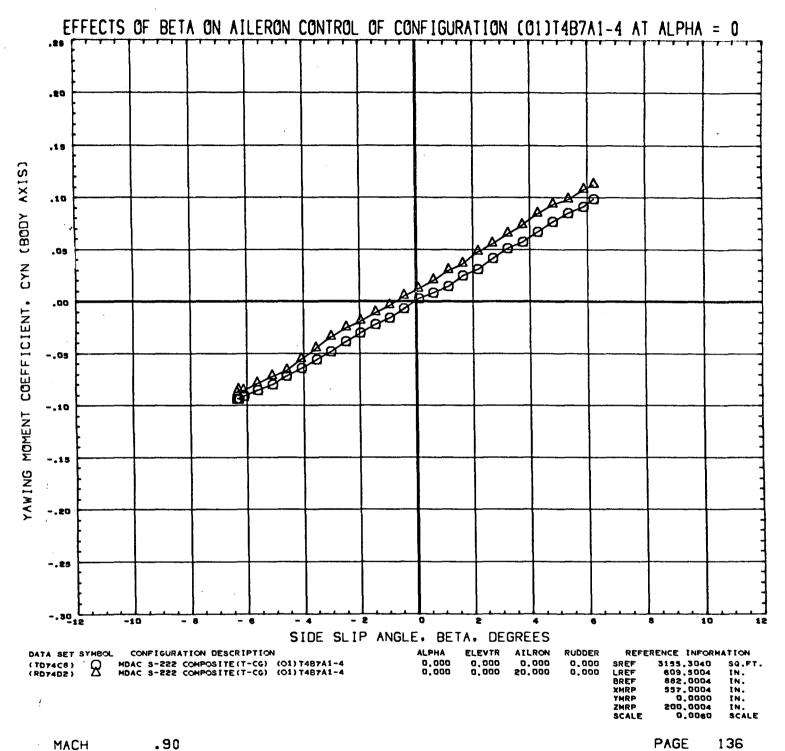


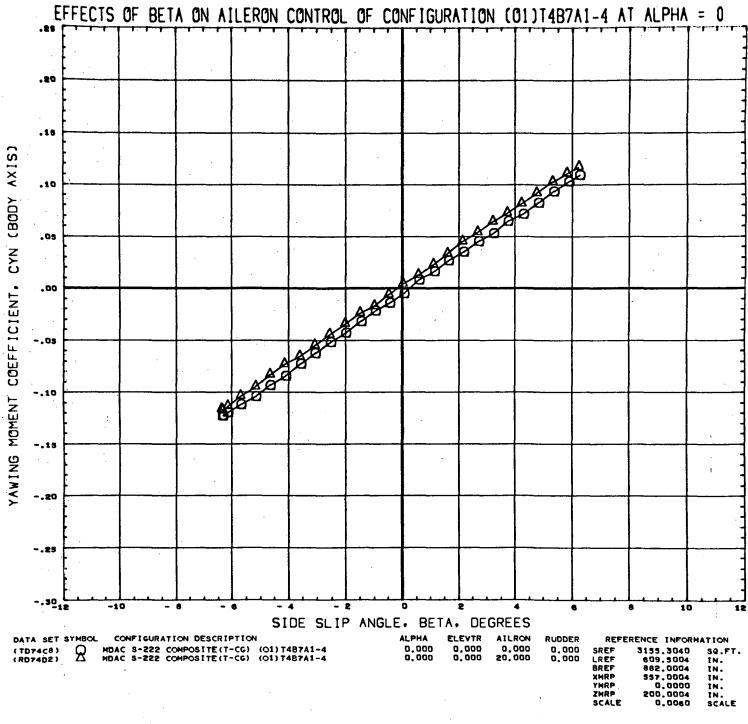


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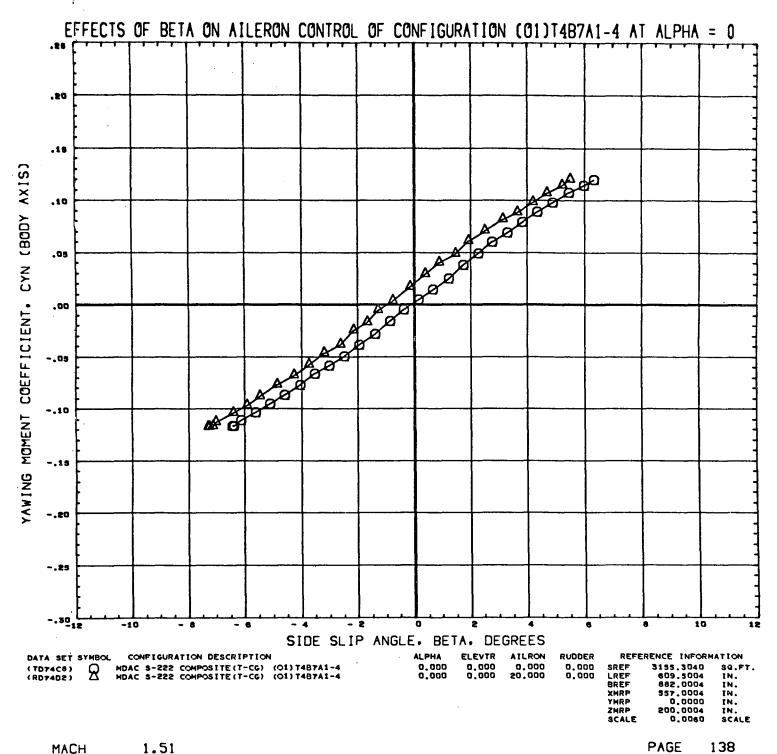
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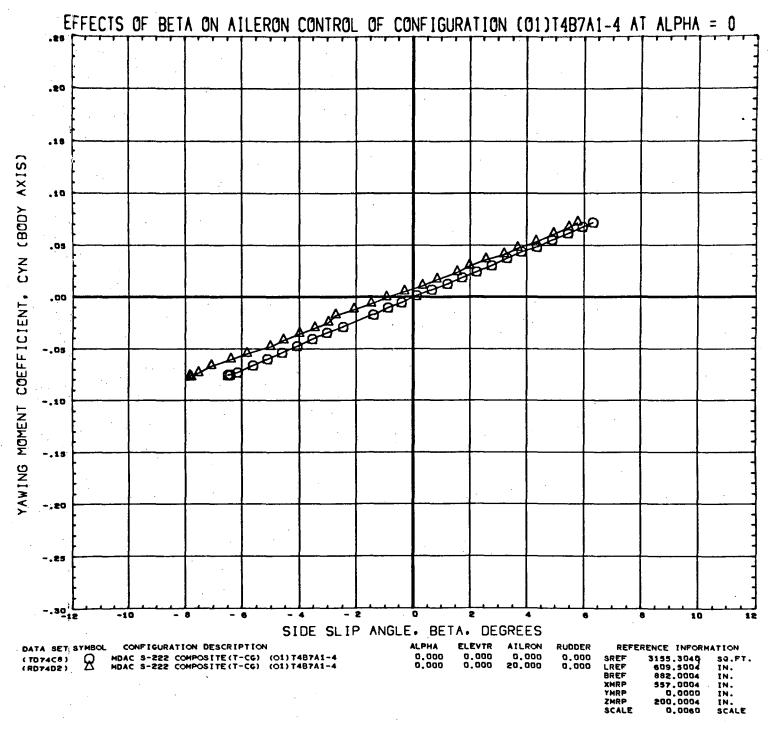




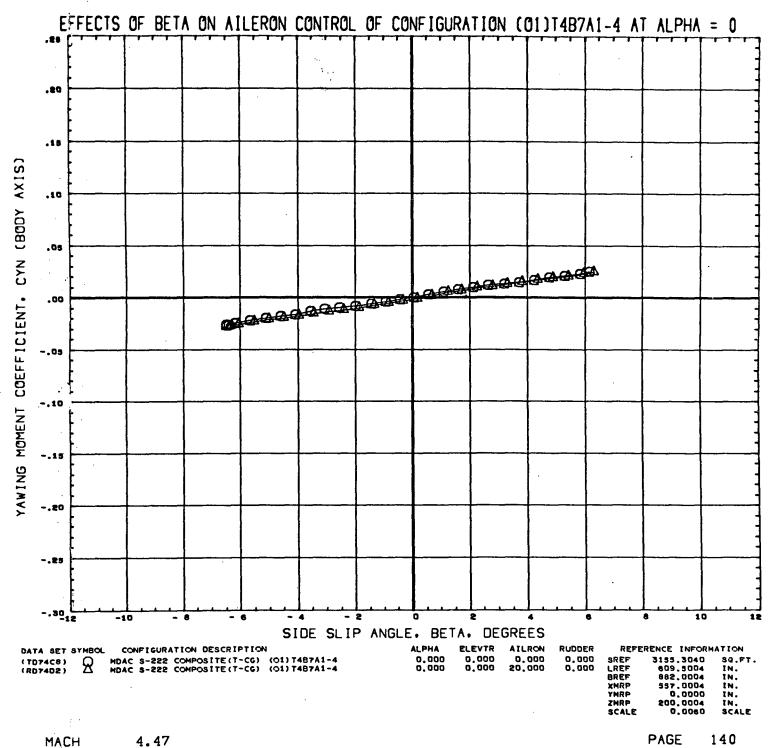
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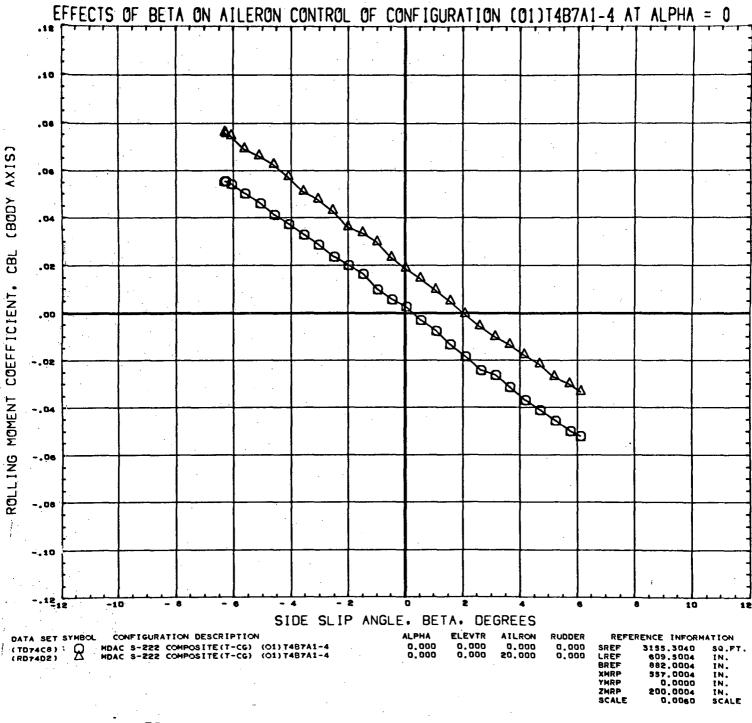
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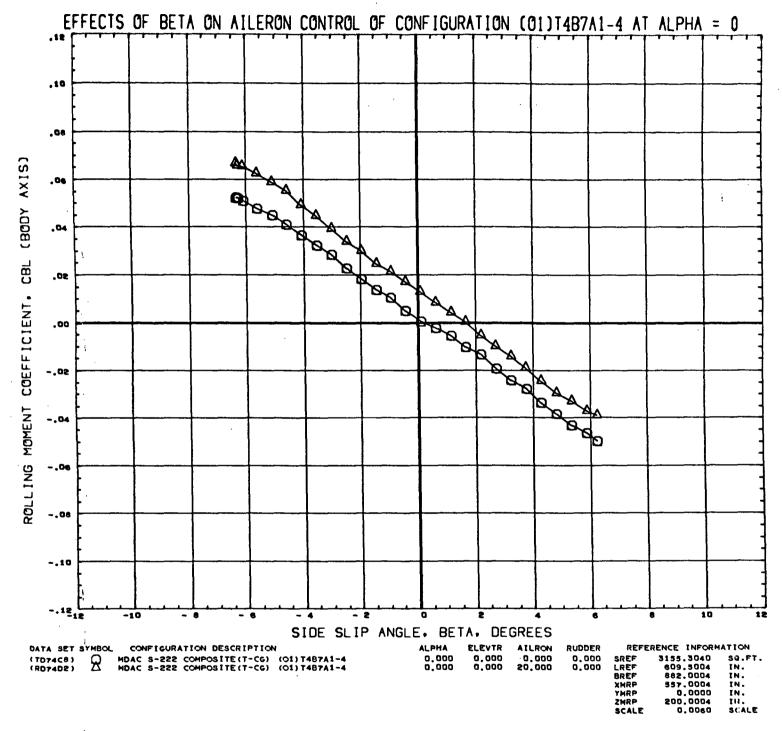
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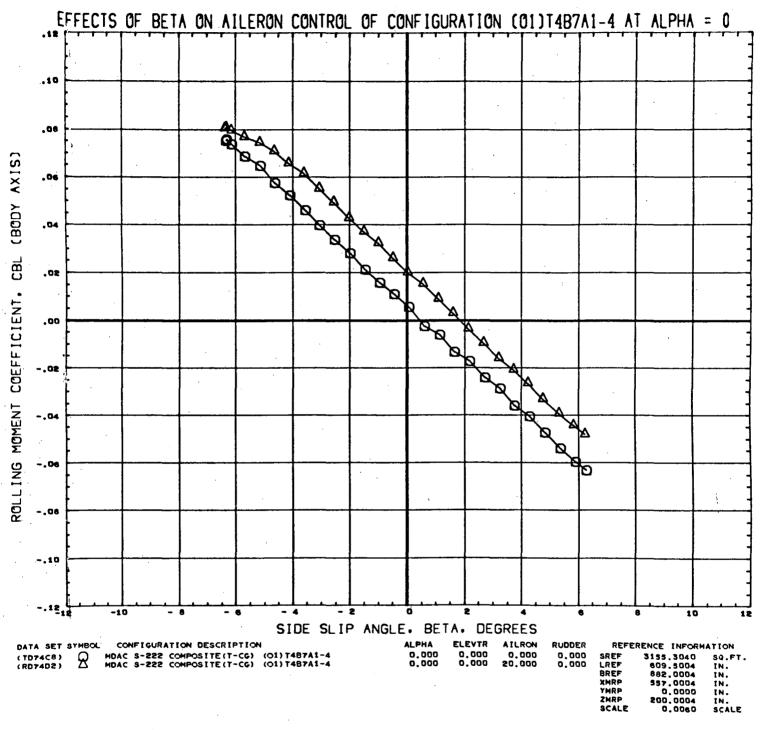
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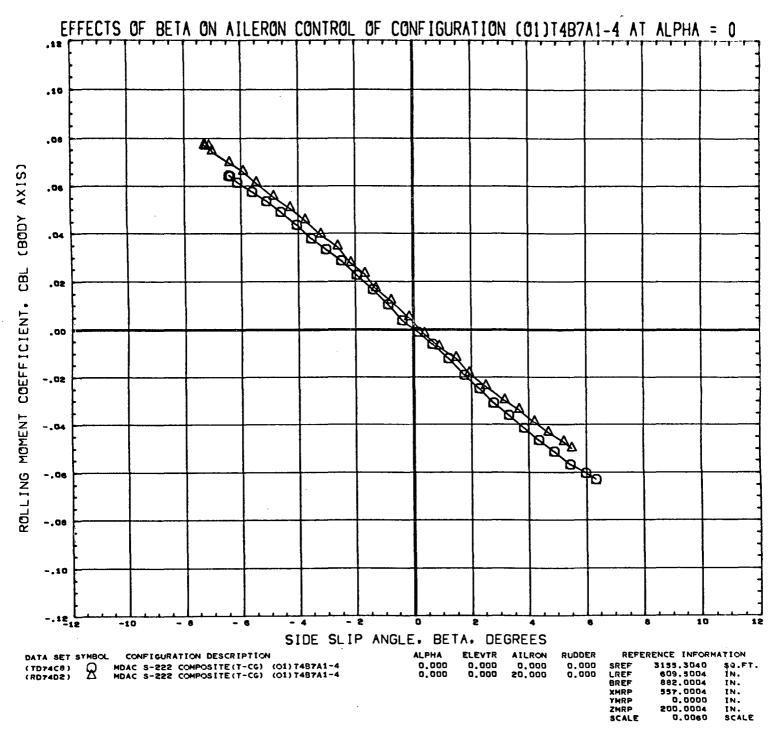
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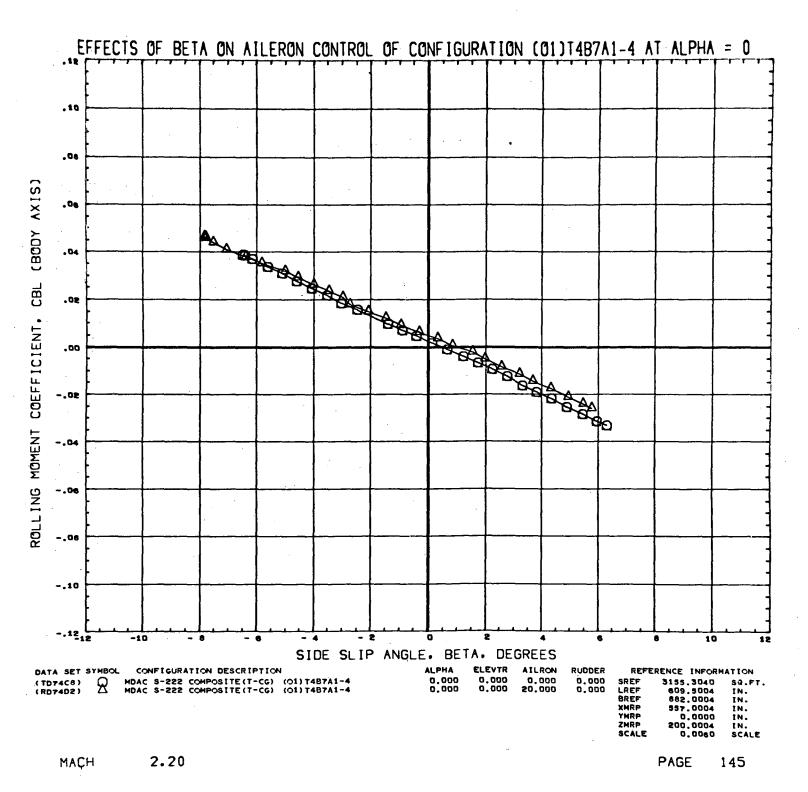


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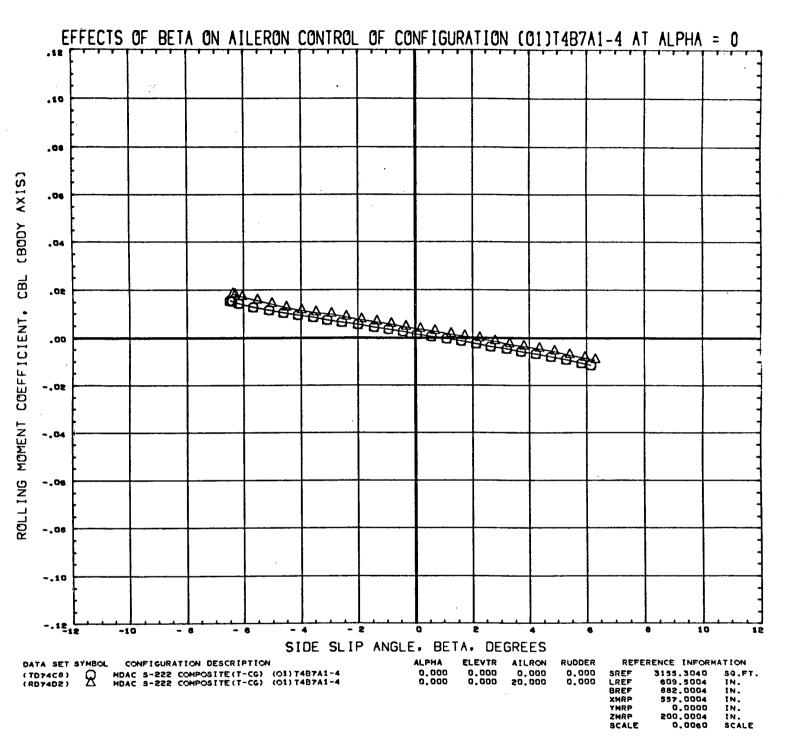


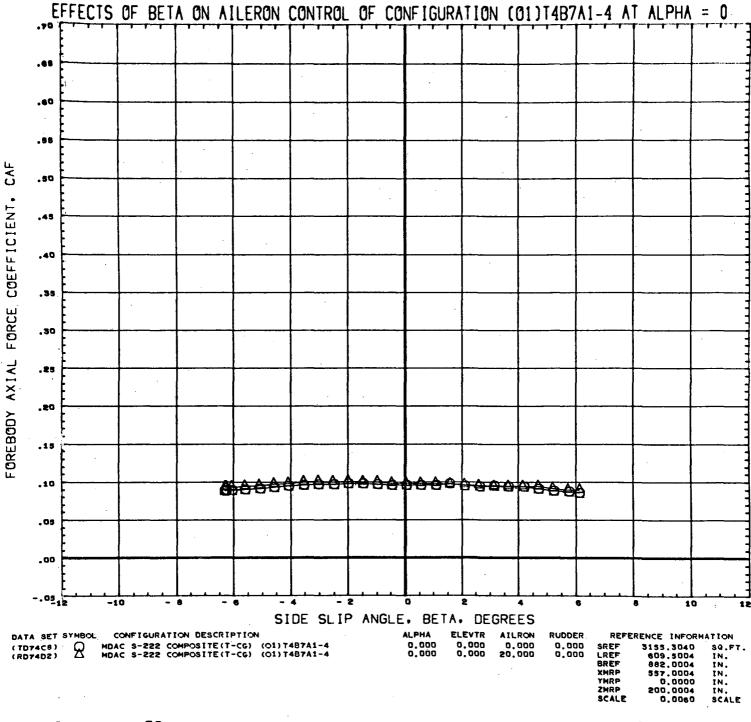
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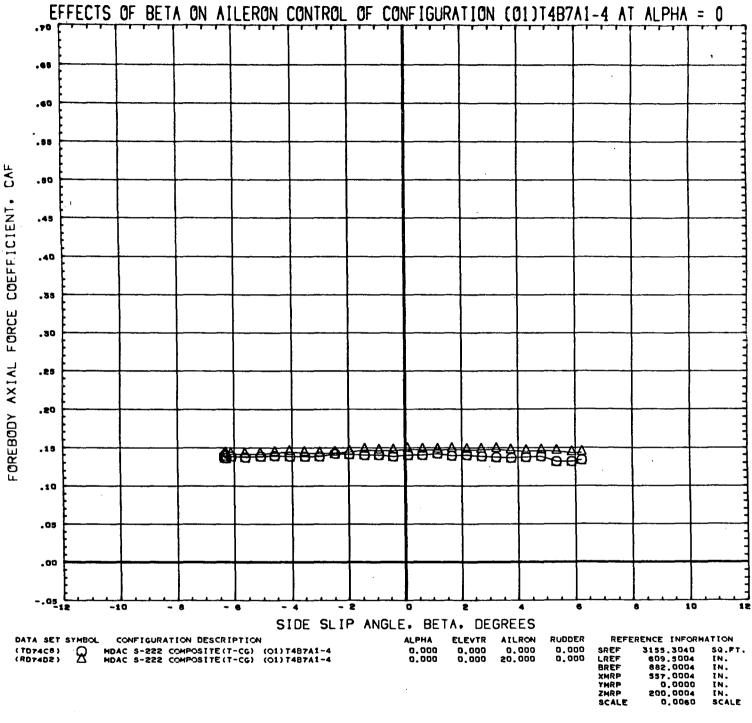


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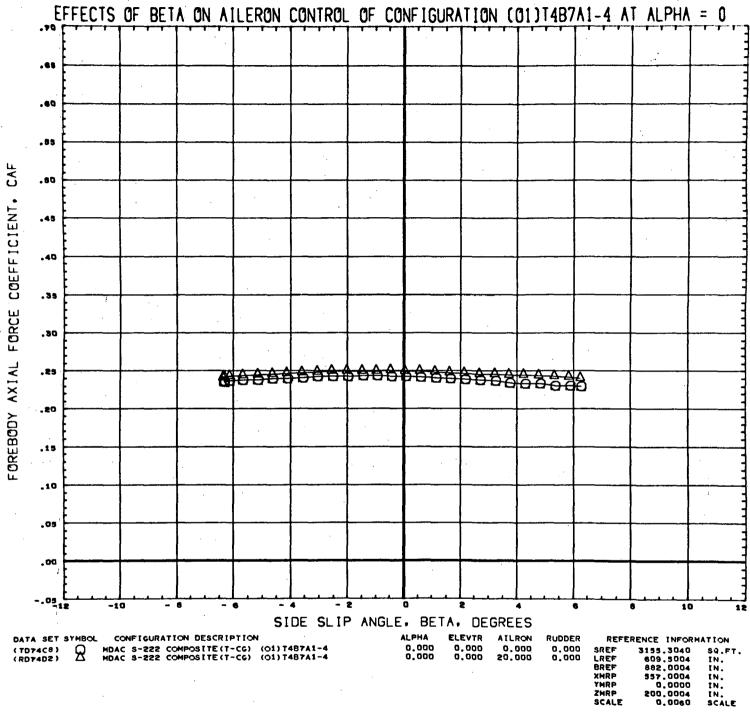




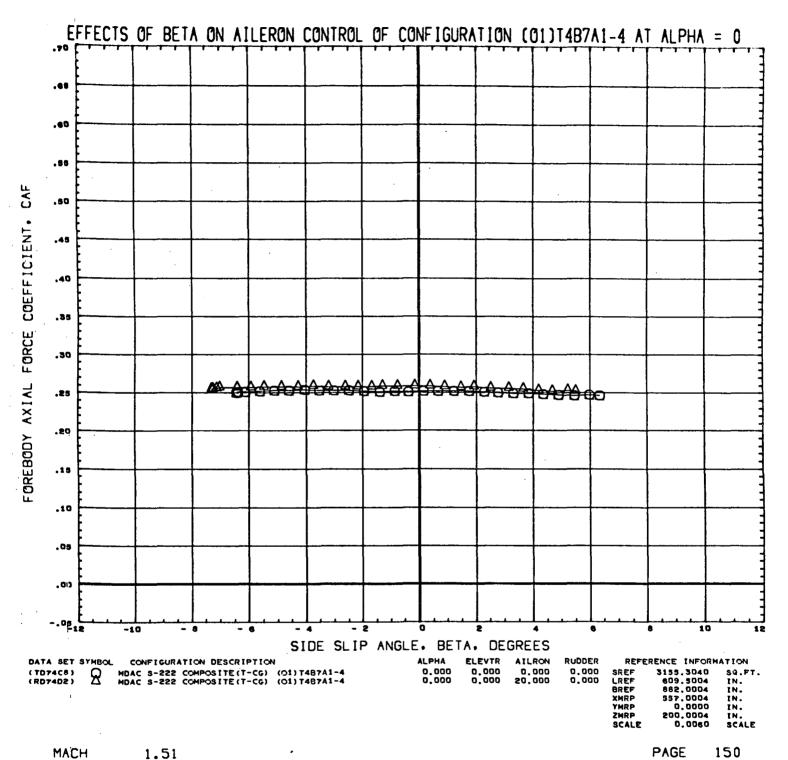
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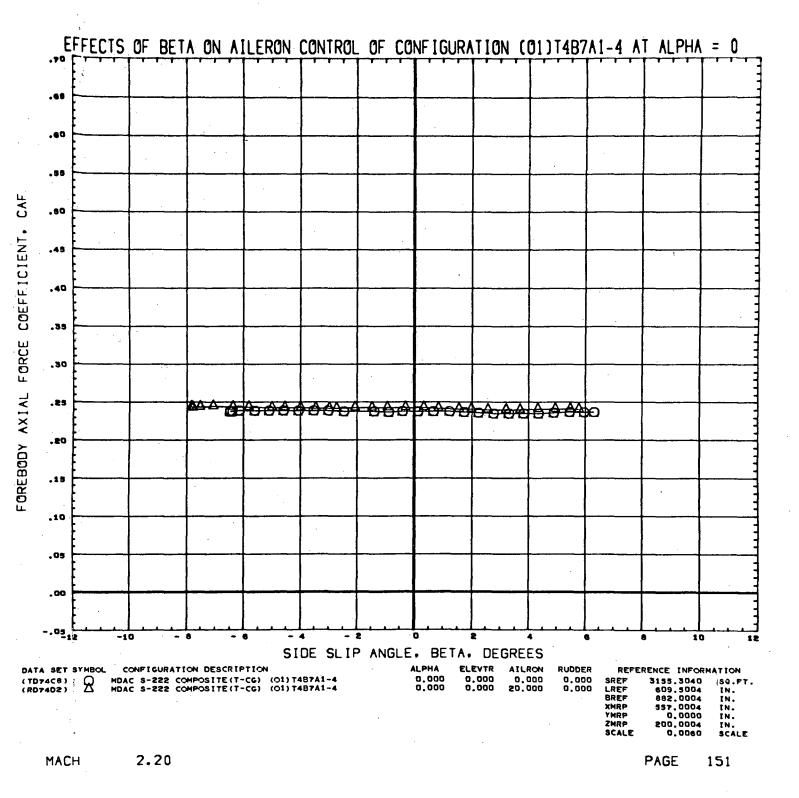


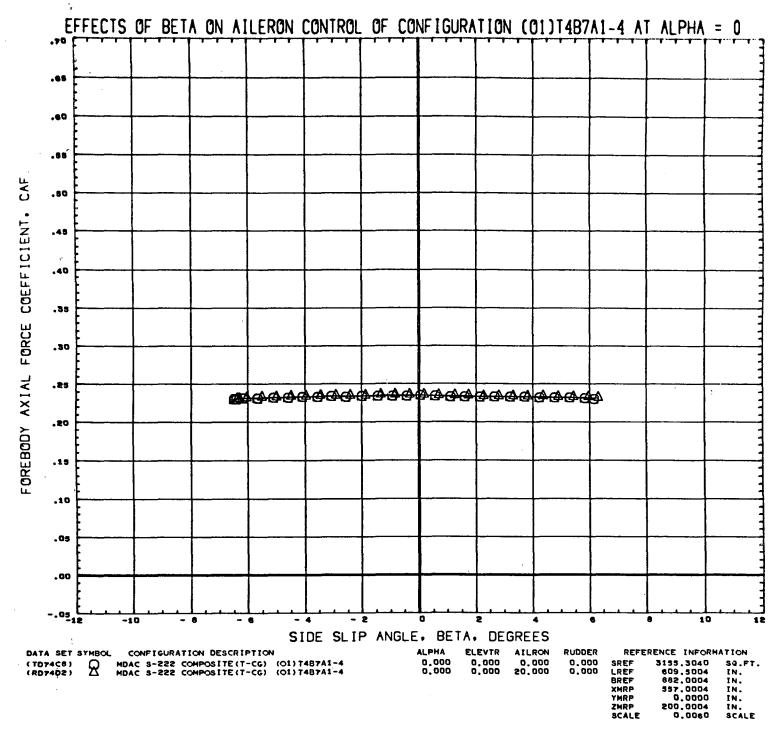
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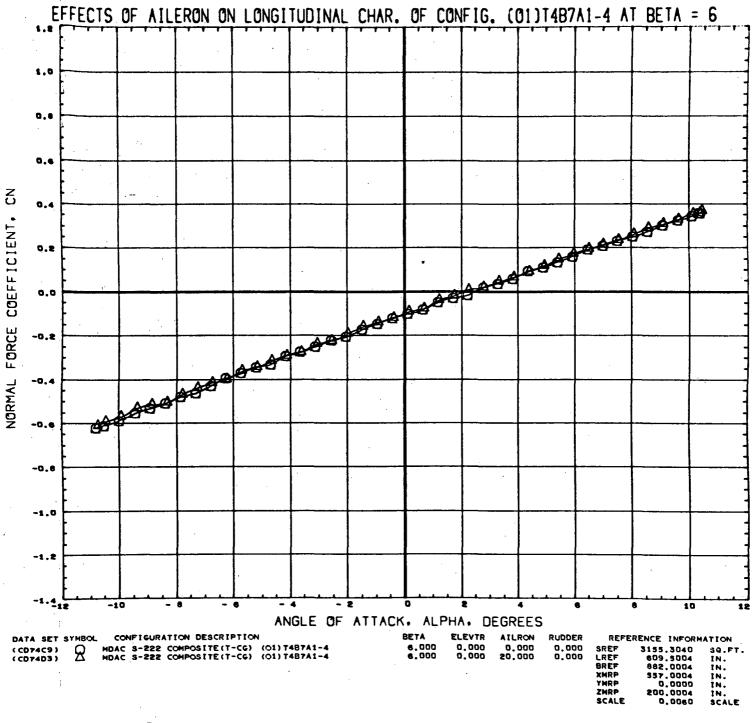
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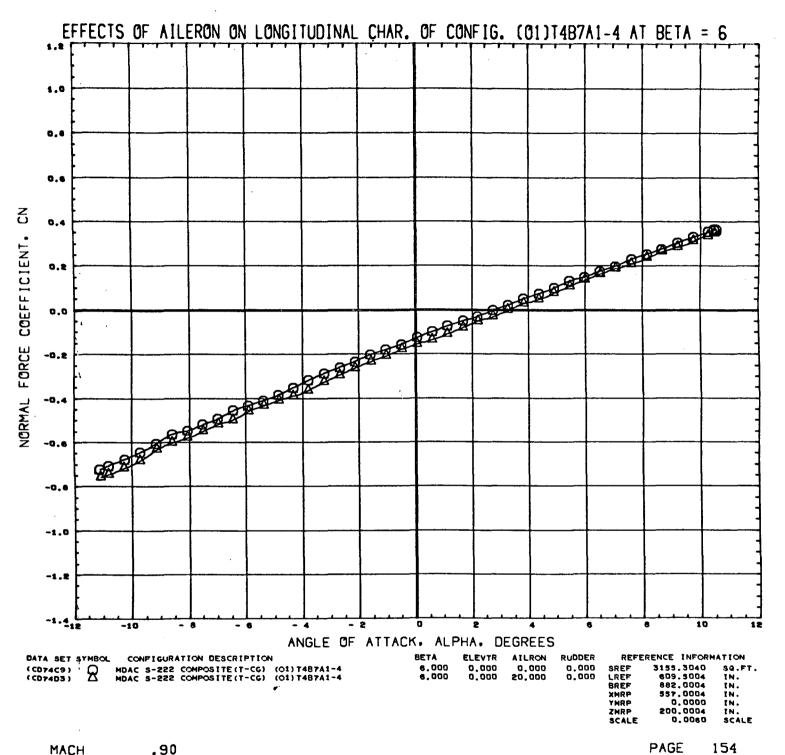




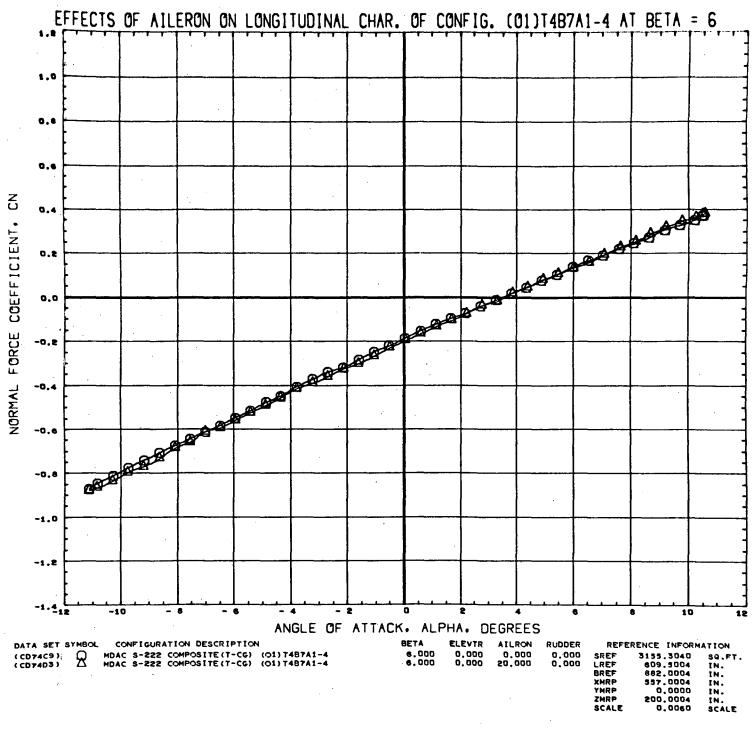
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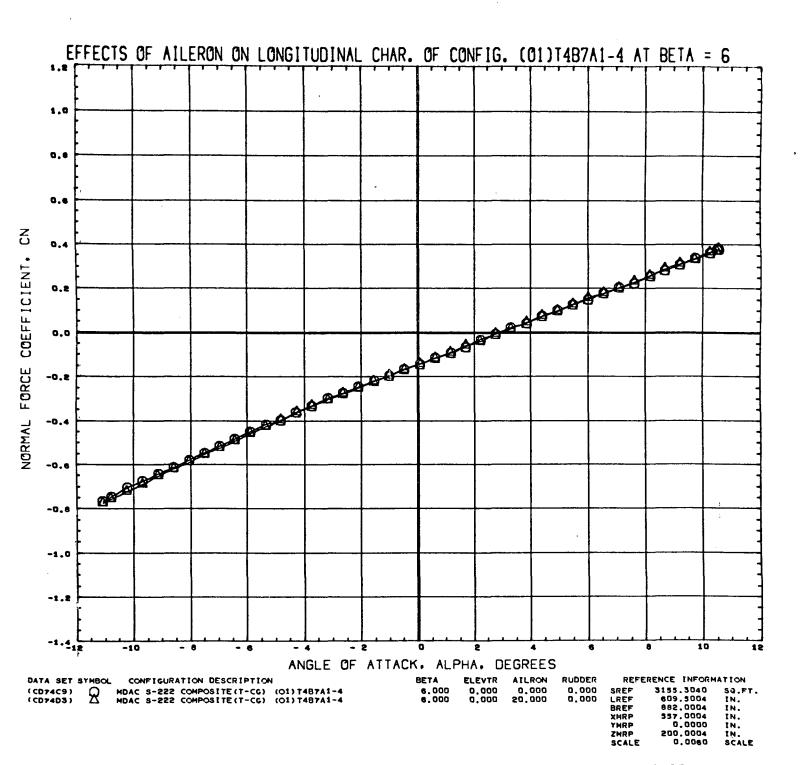
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MACH 1.10

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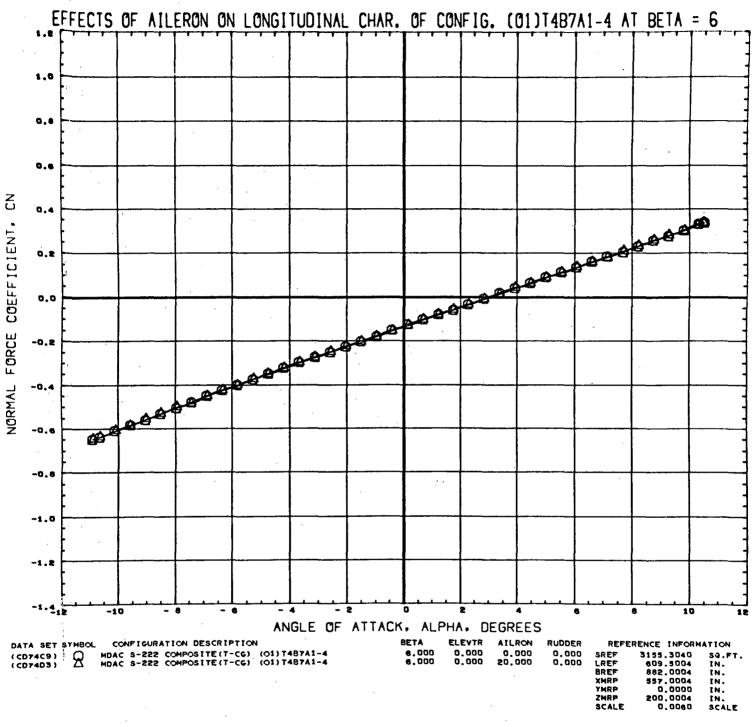
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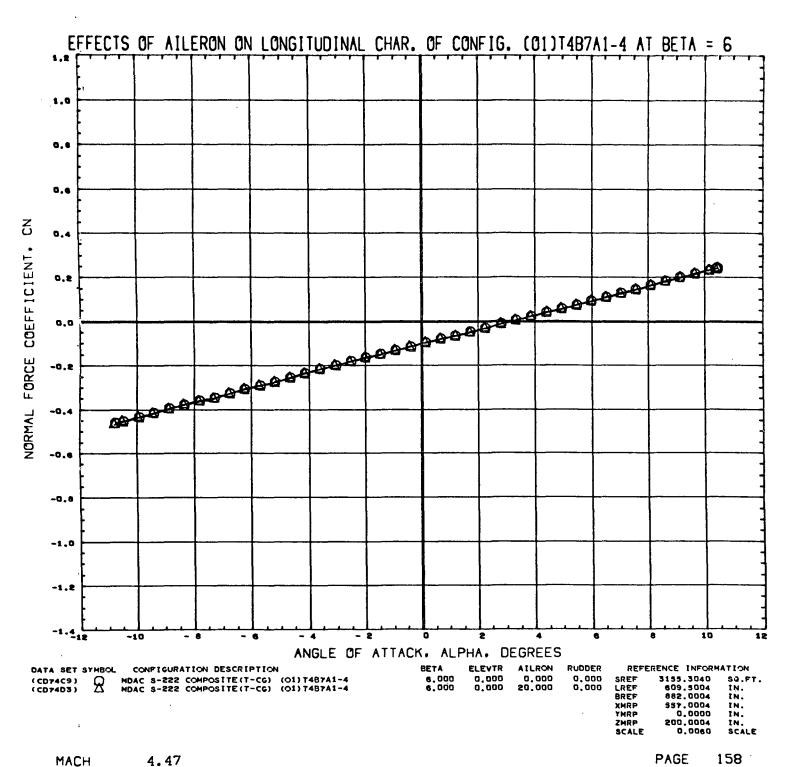
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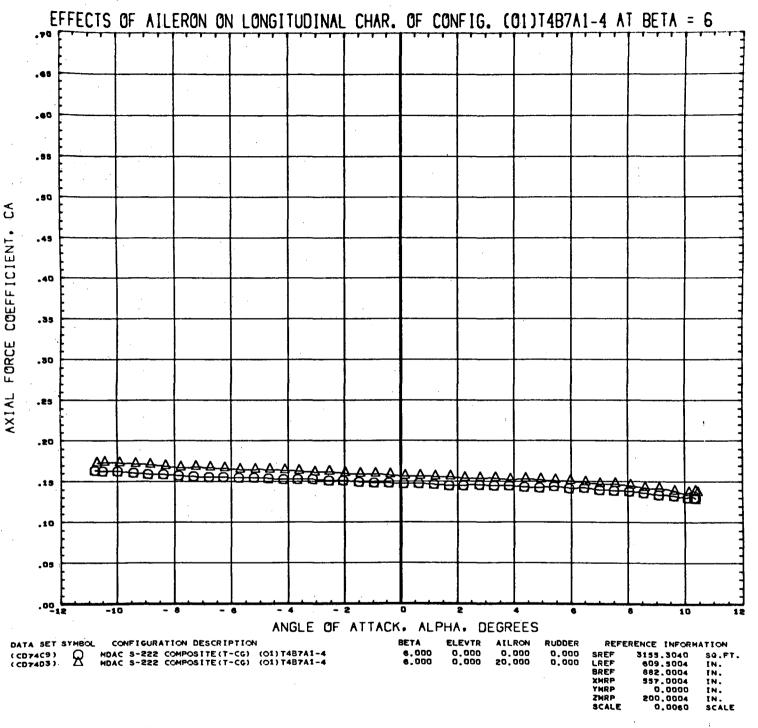
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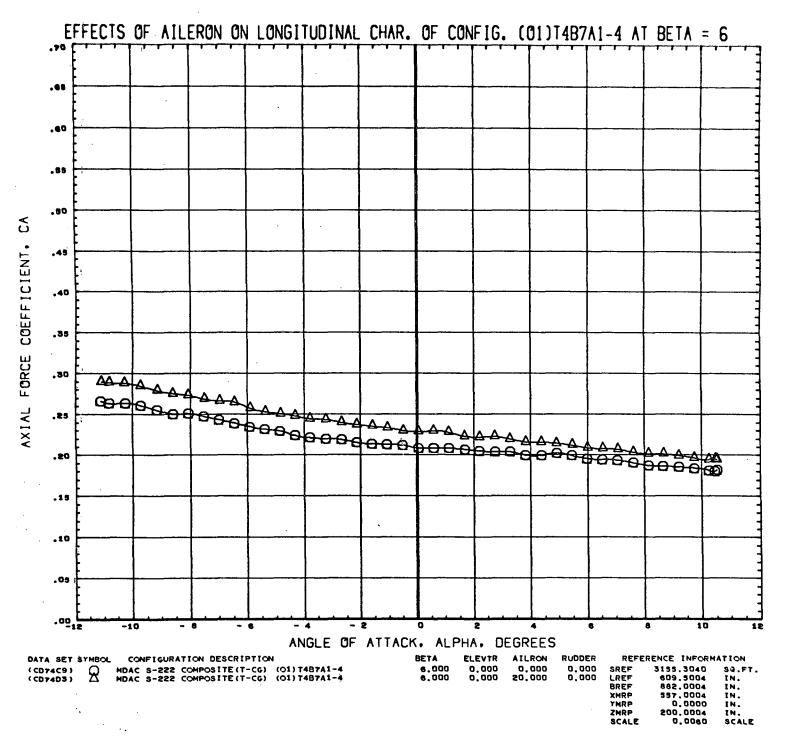


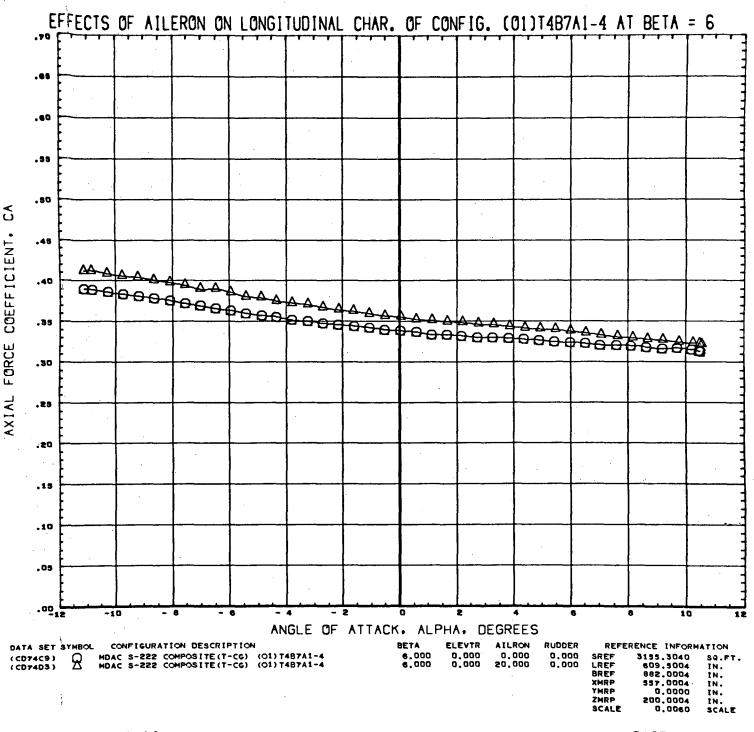
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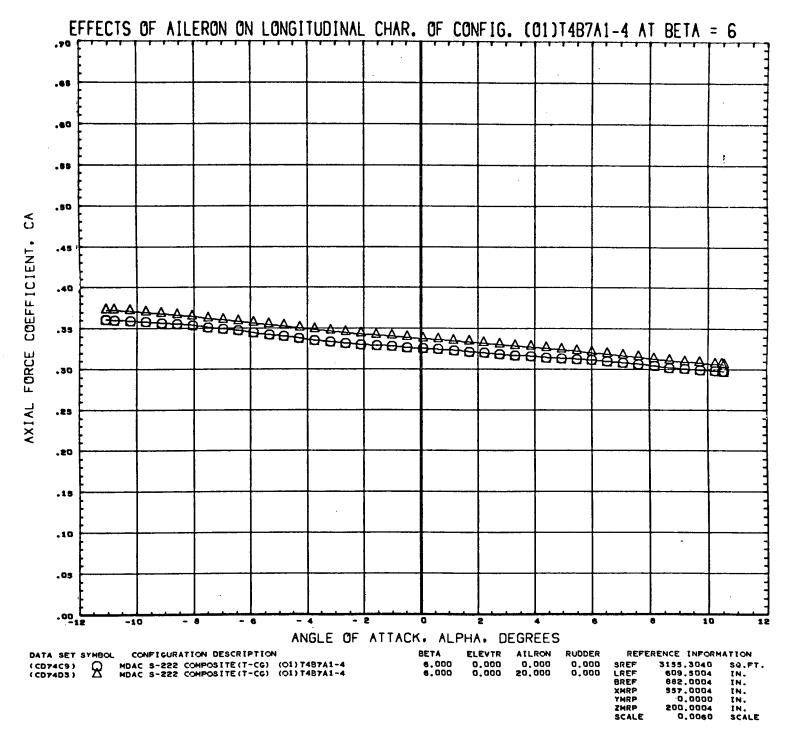


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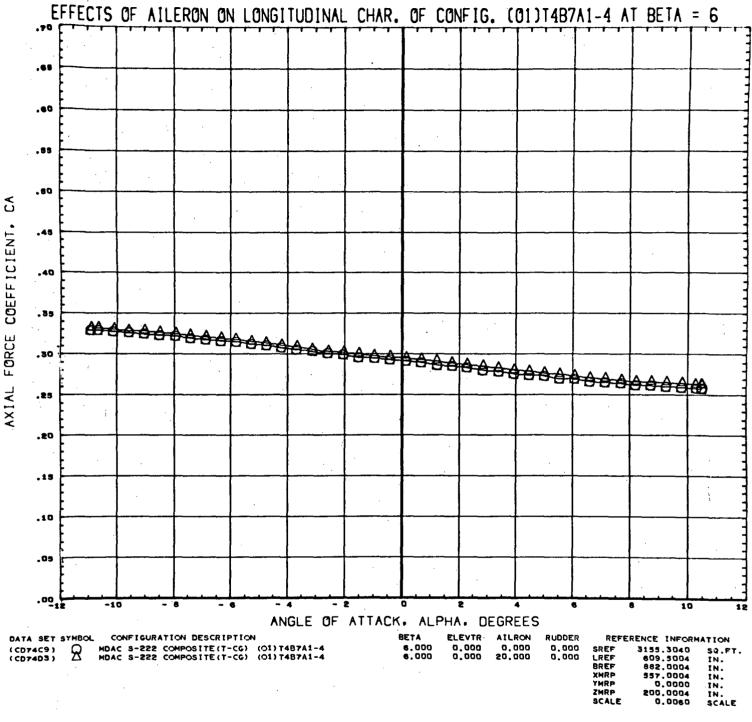


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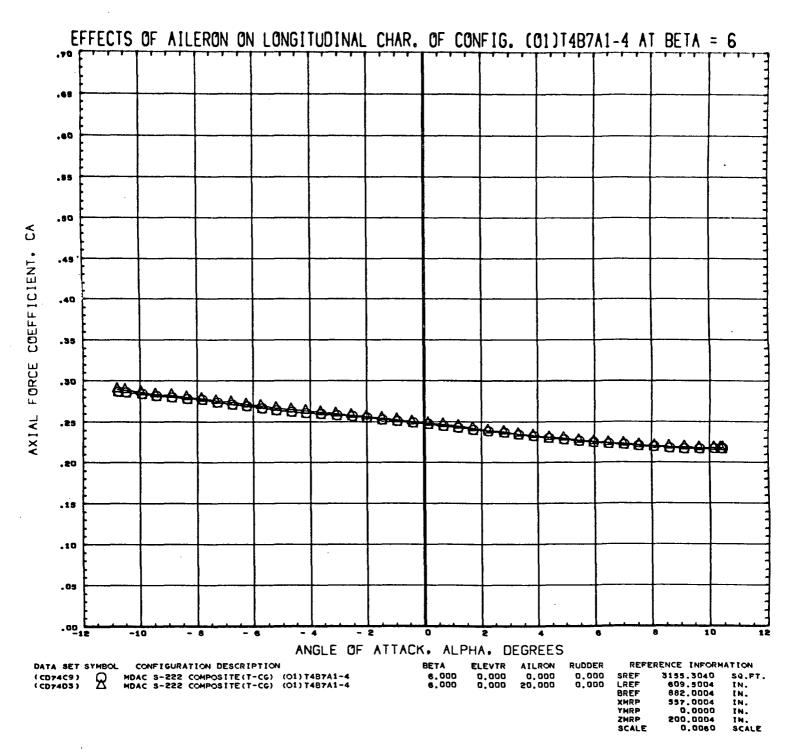


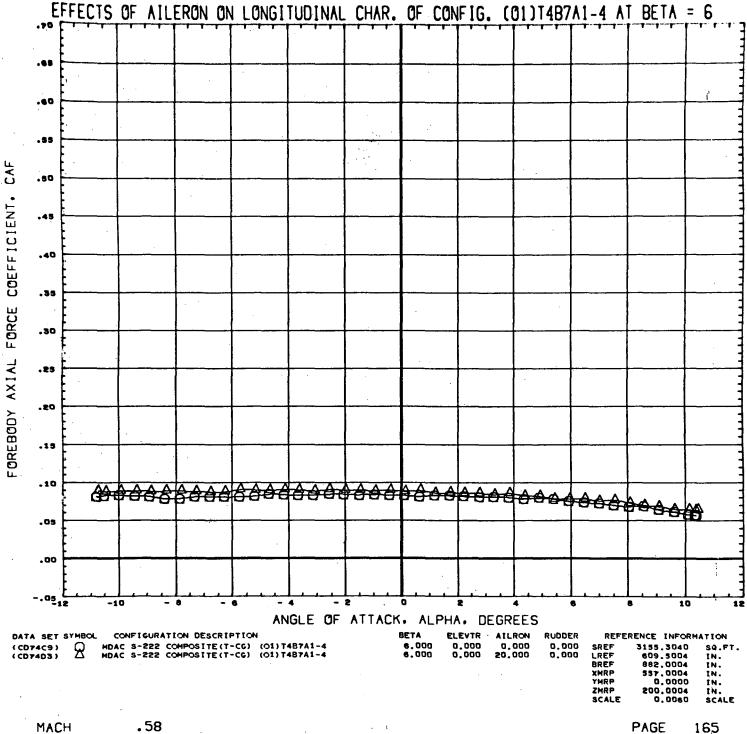
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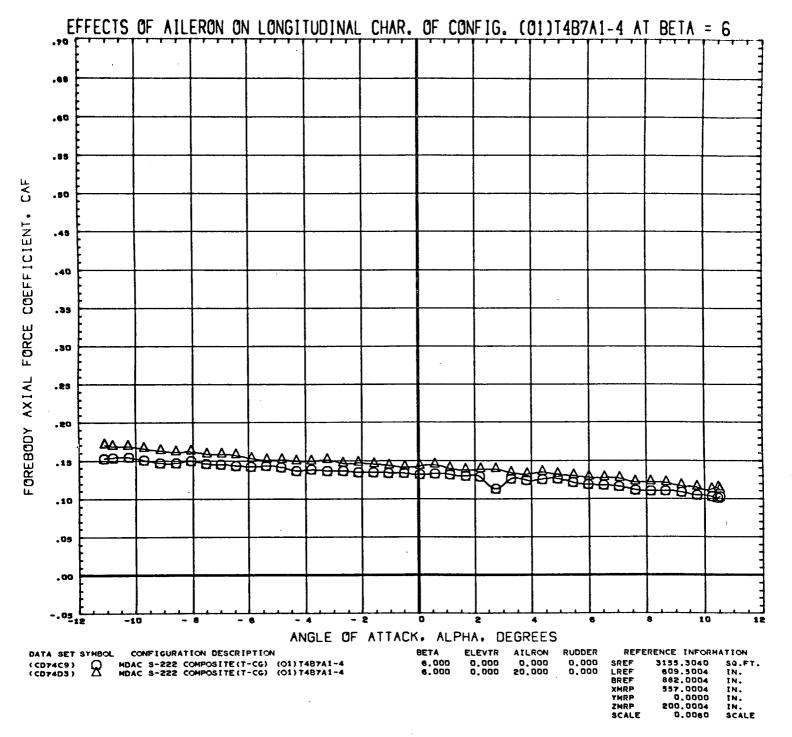
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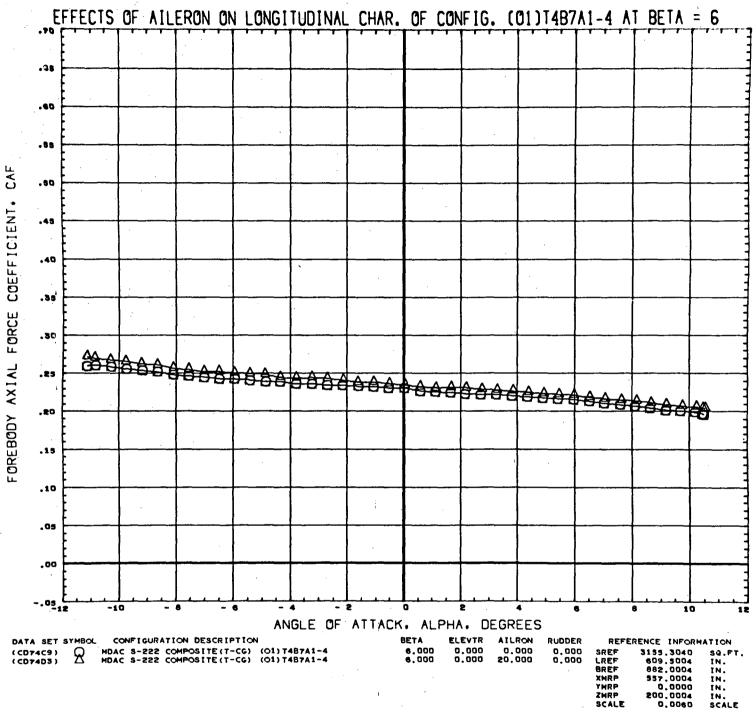


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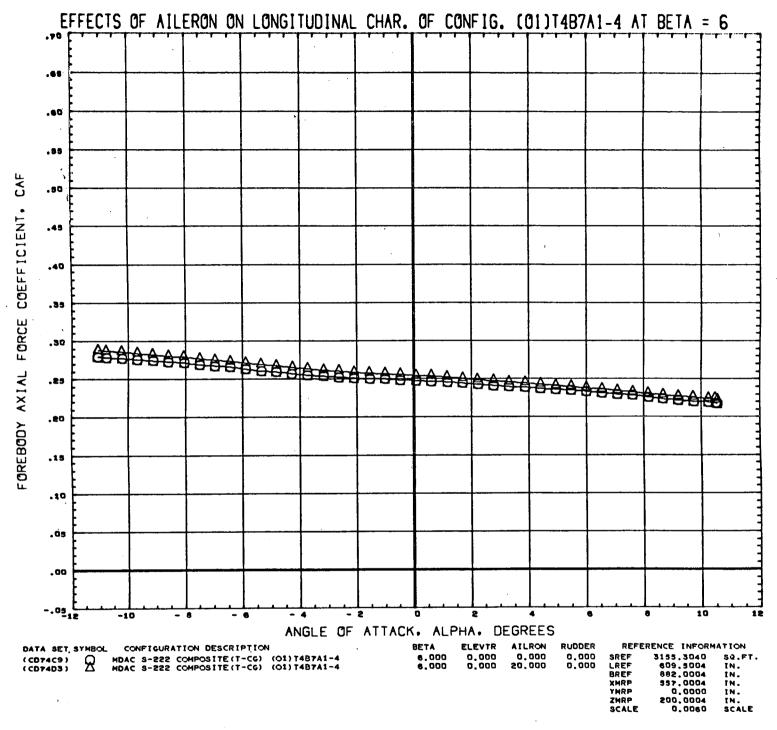
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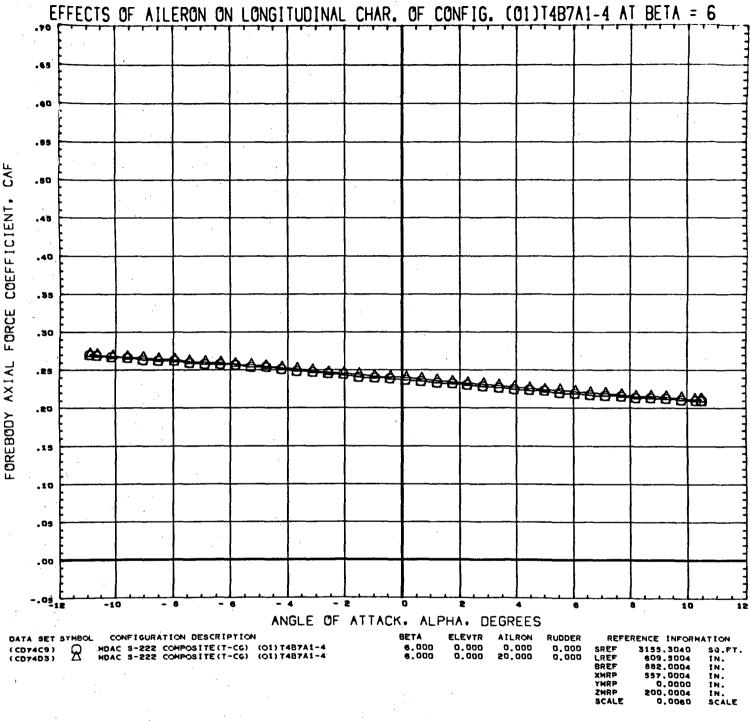
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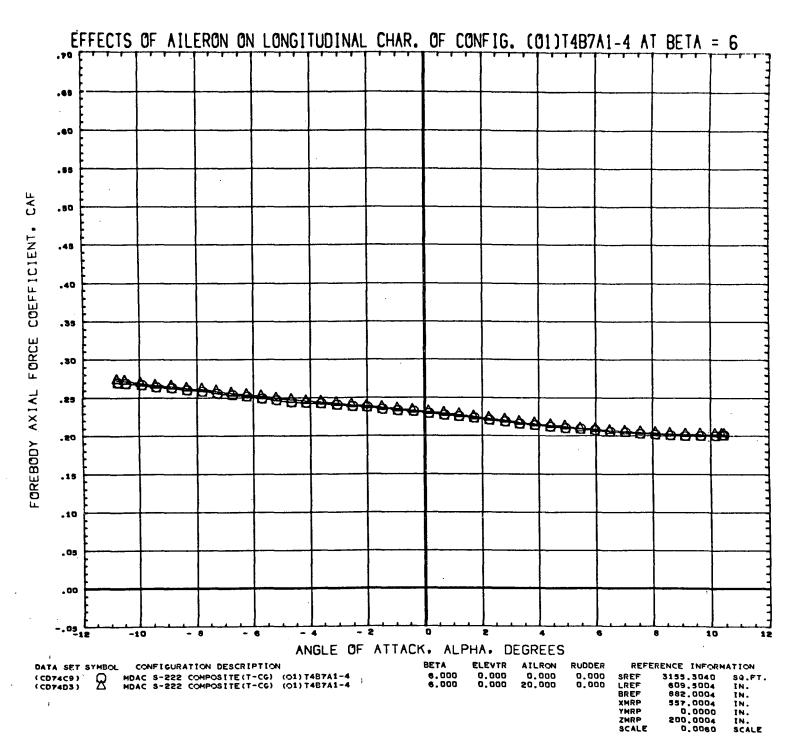
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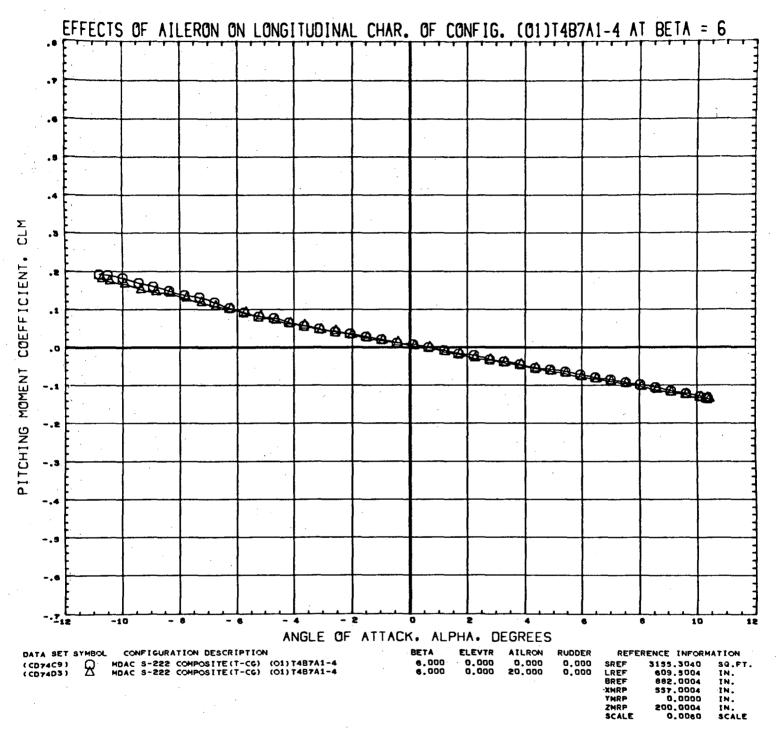


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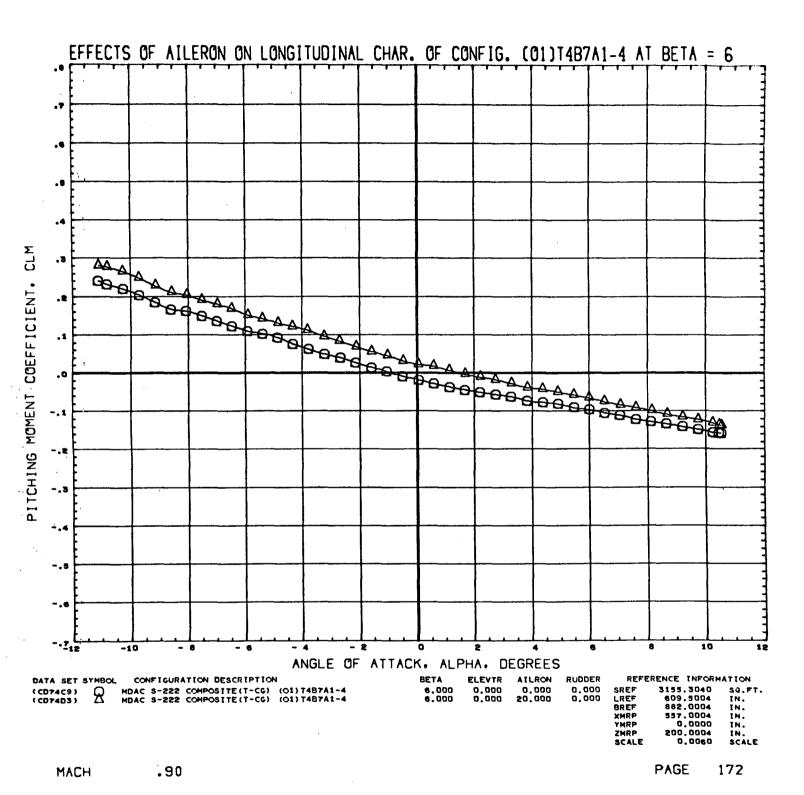
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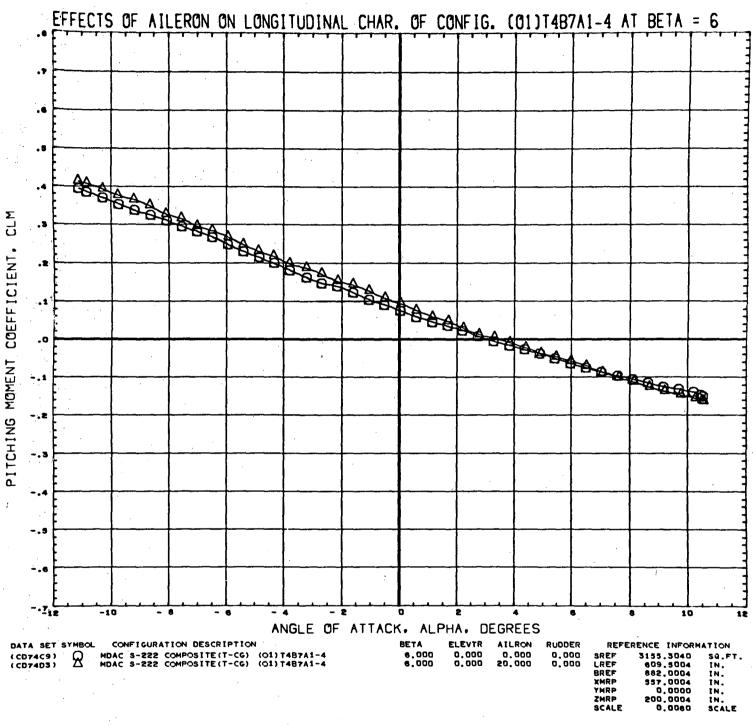




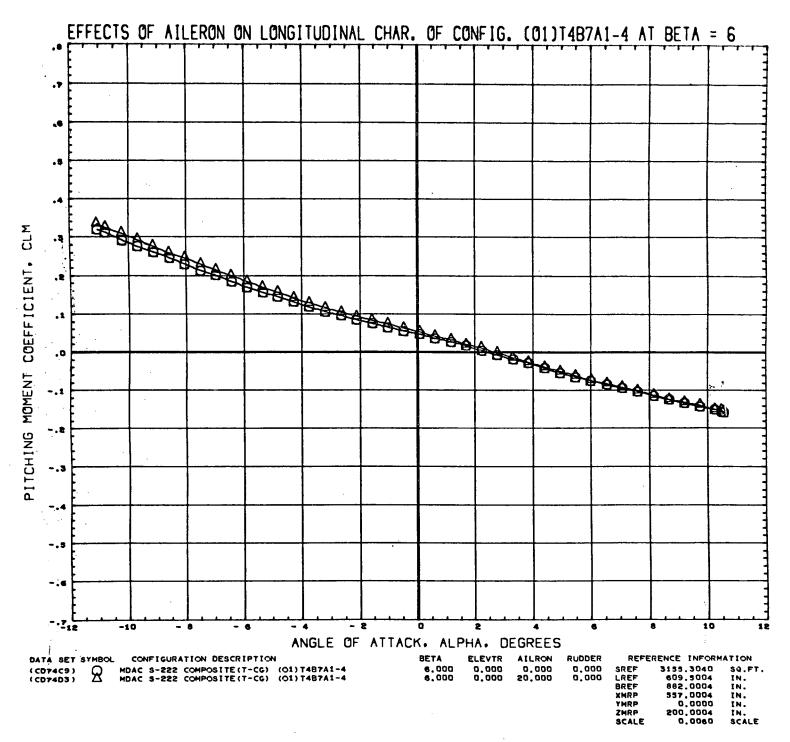
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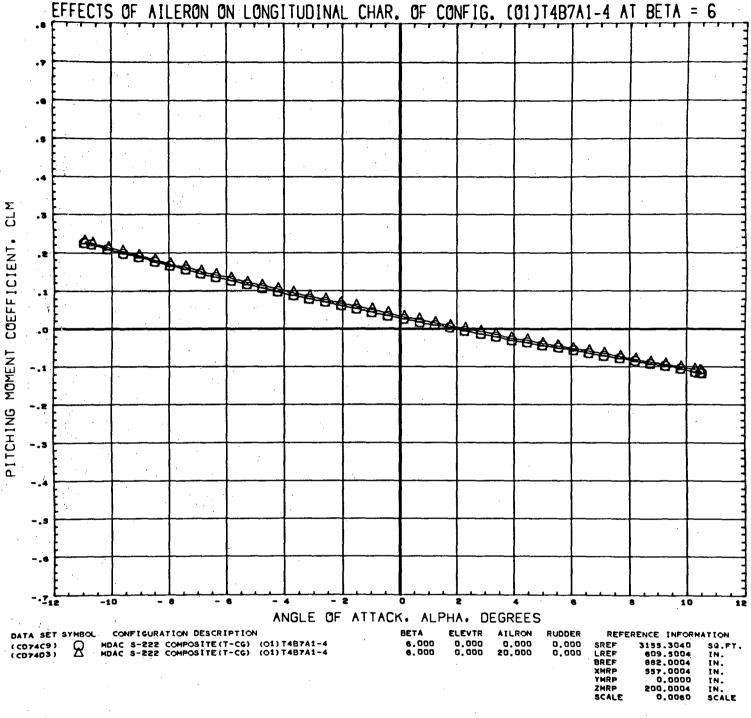
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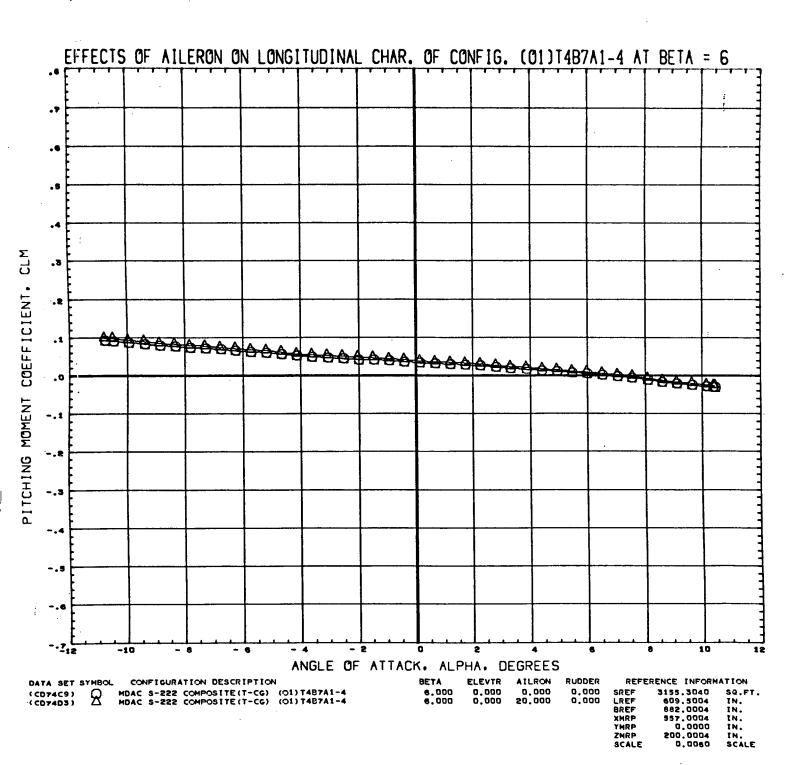
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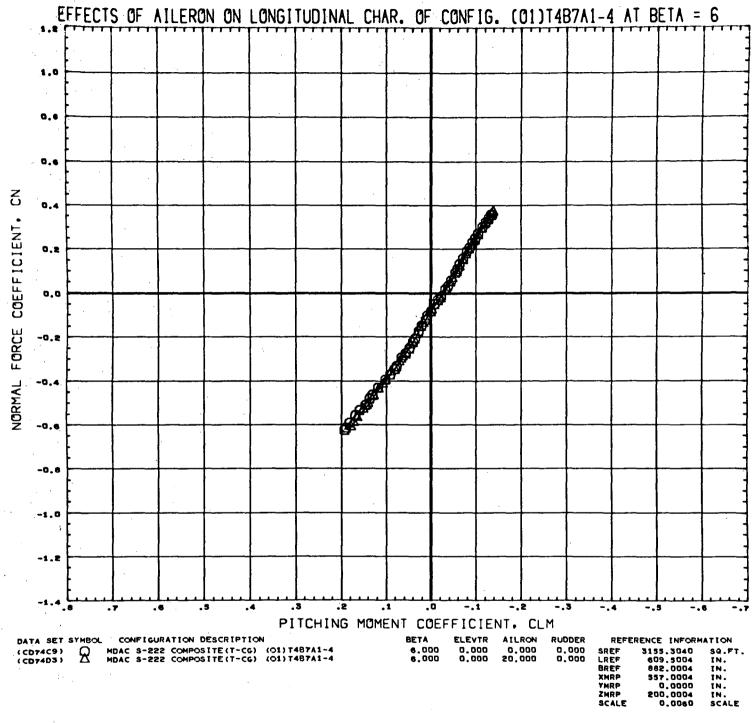
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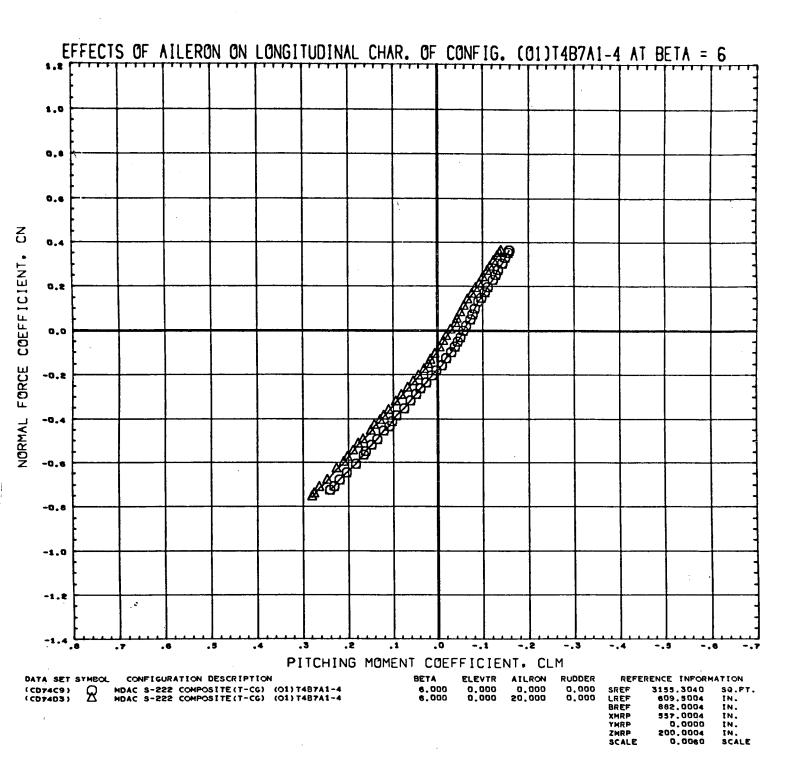
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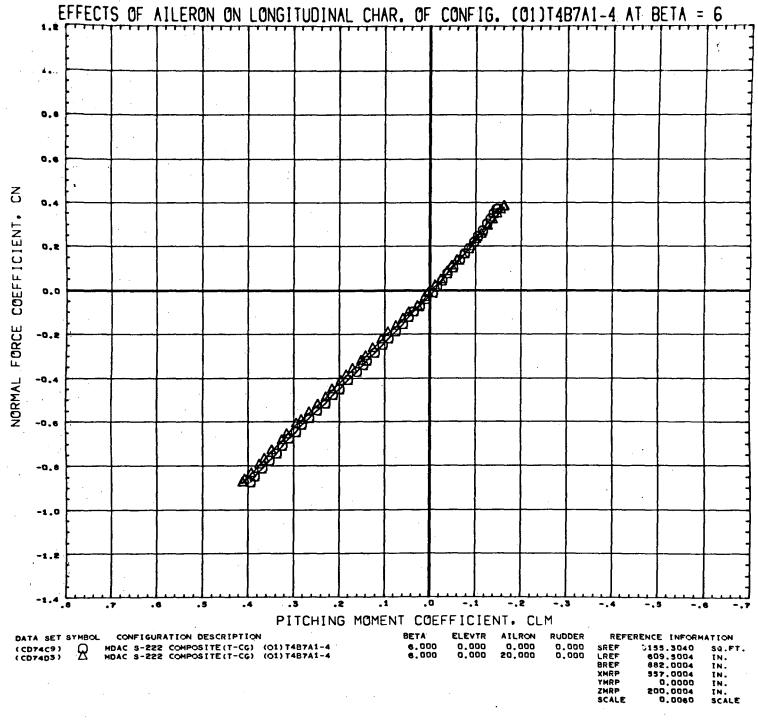


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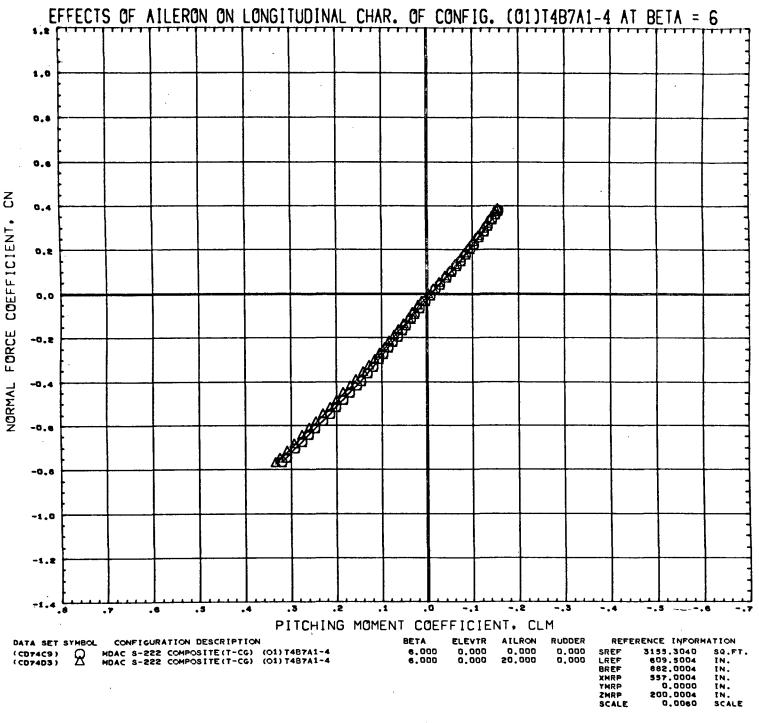


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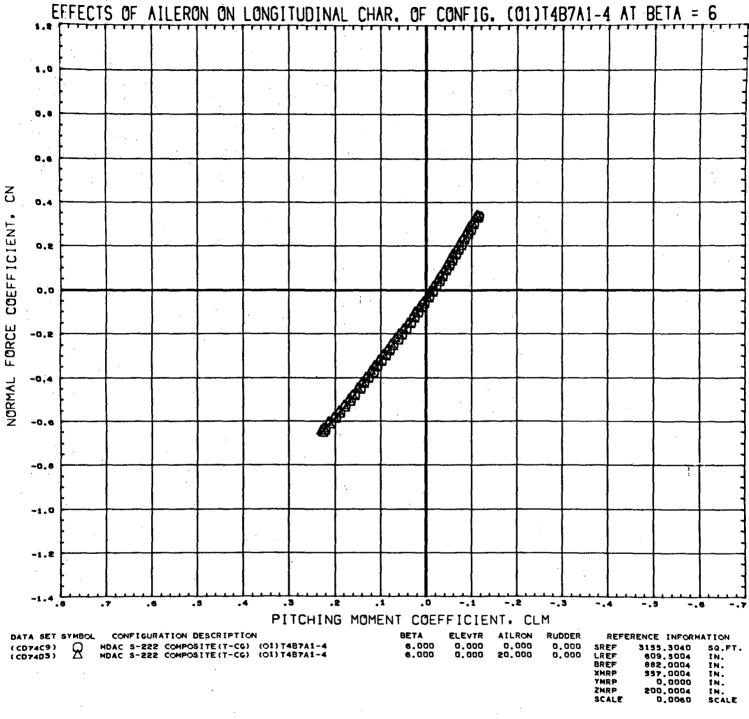




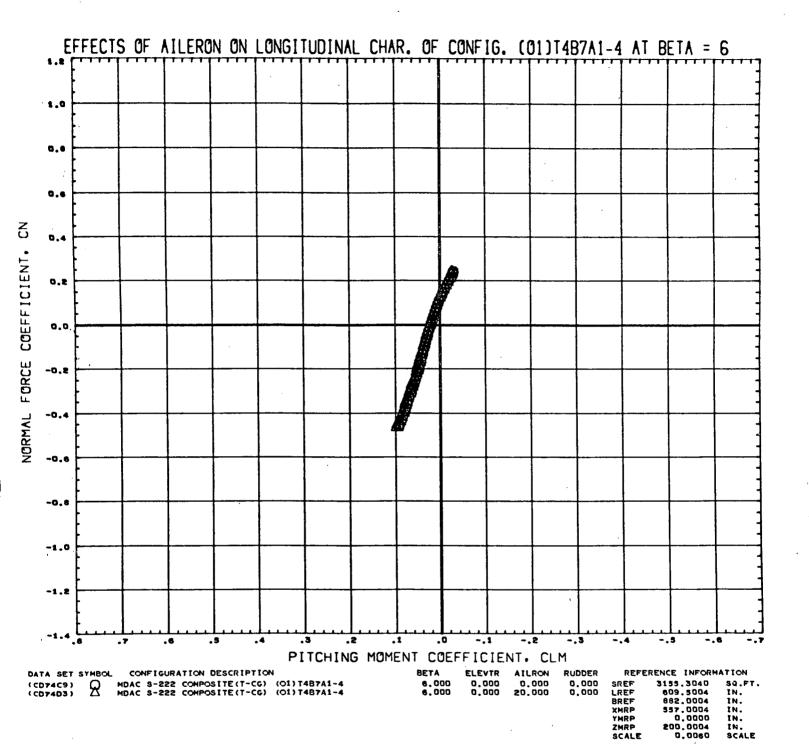
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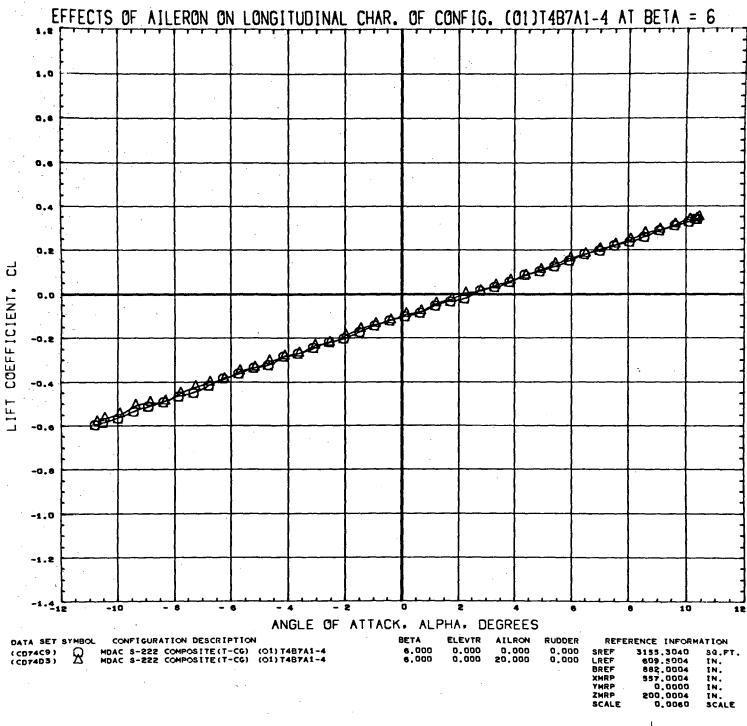


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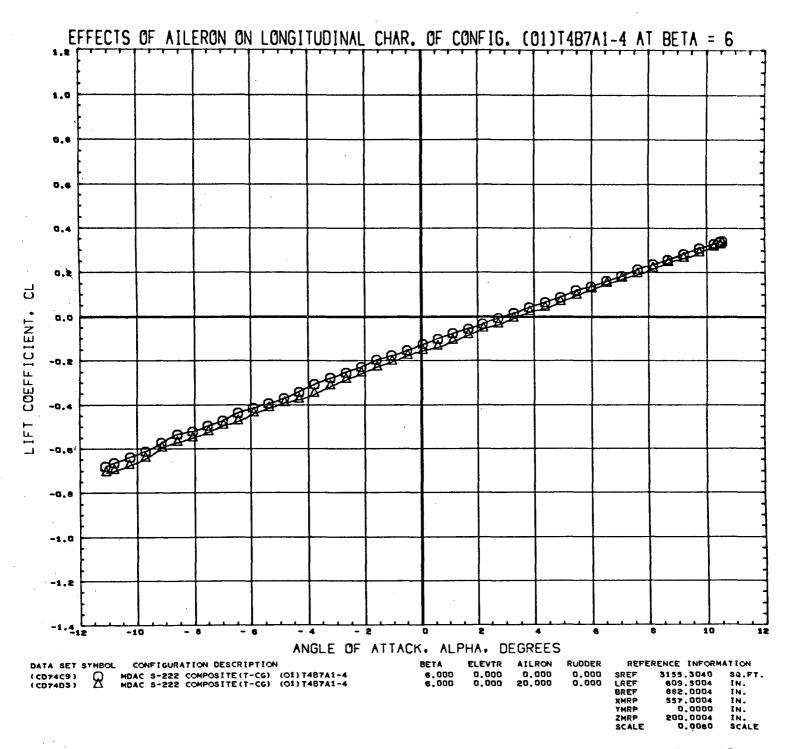
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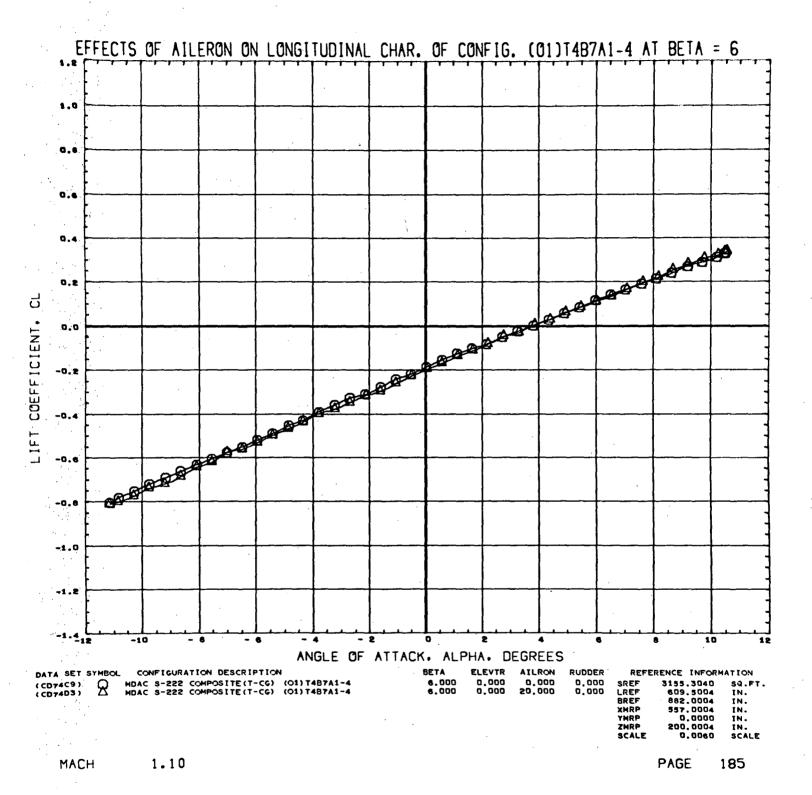
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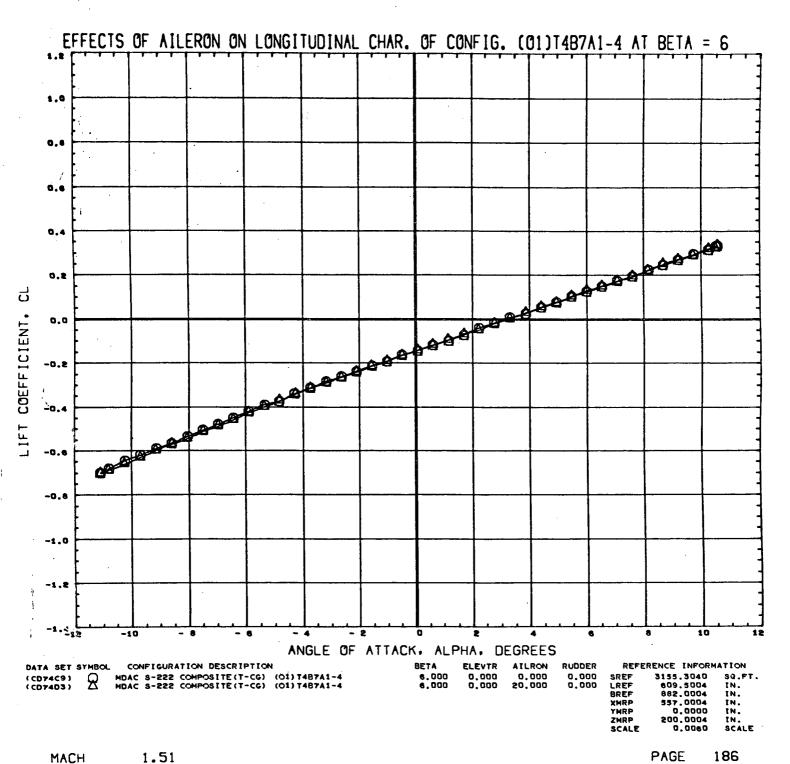


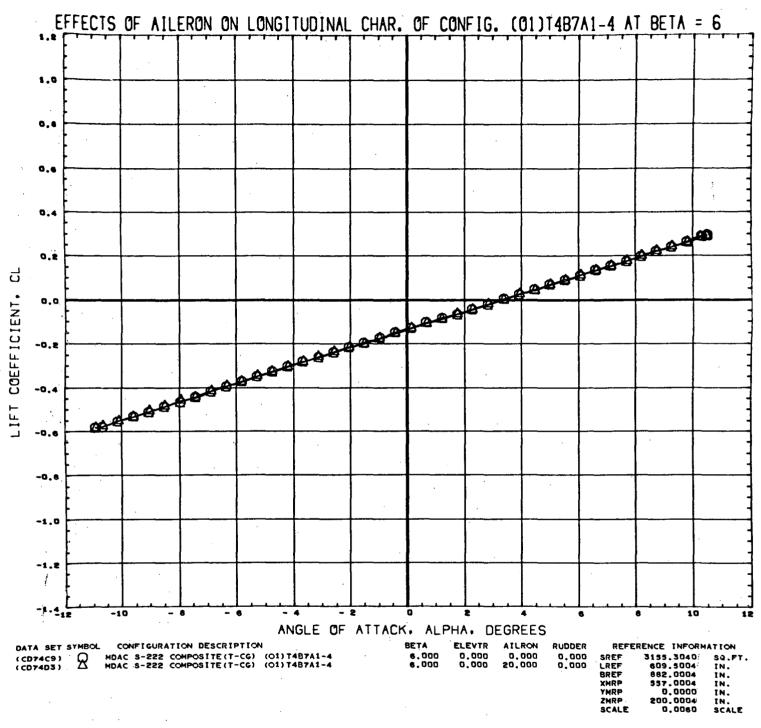
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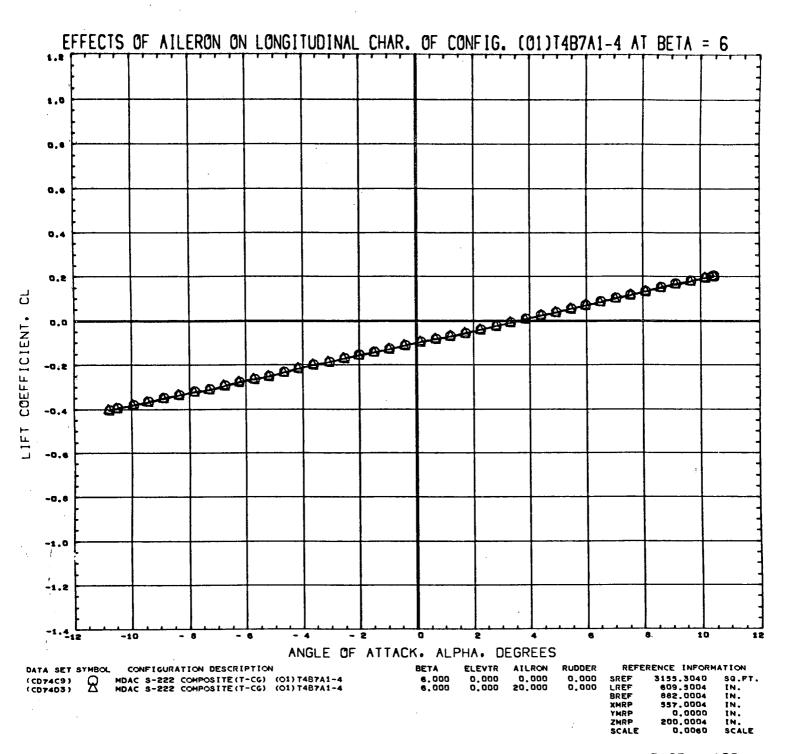




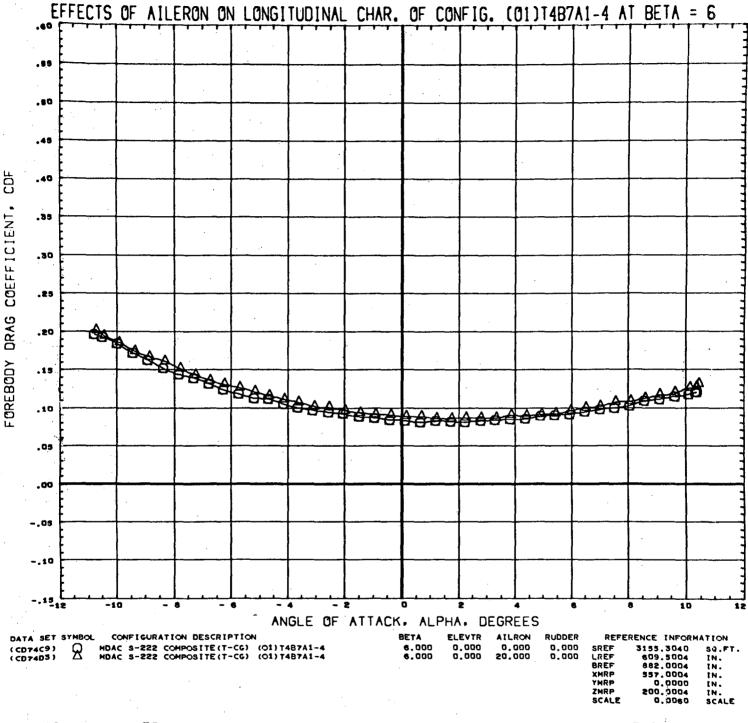




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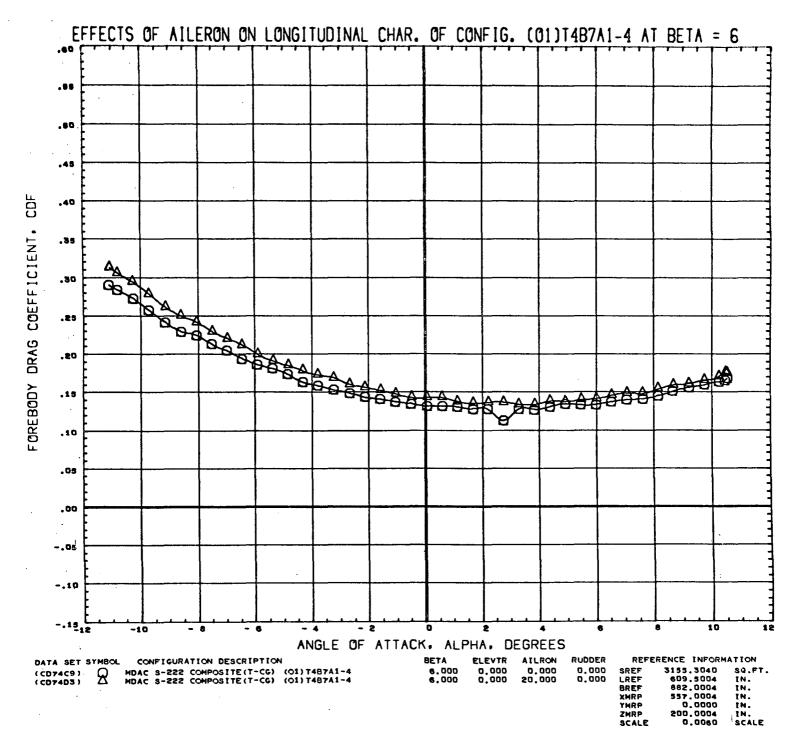
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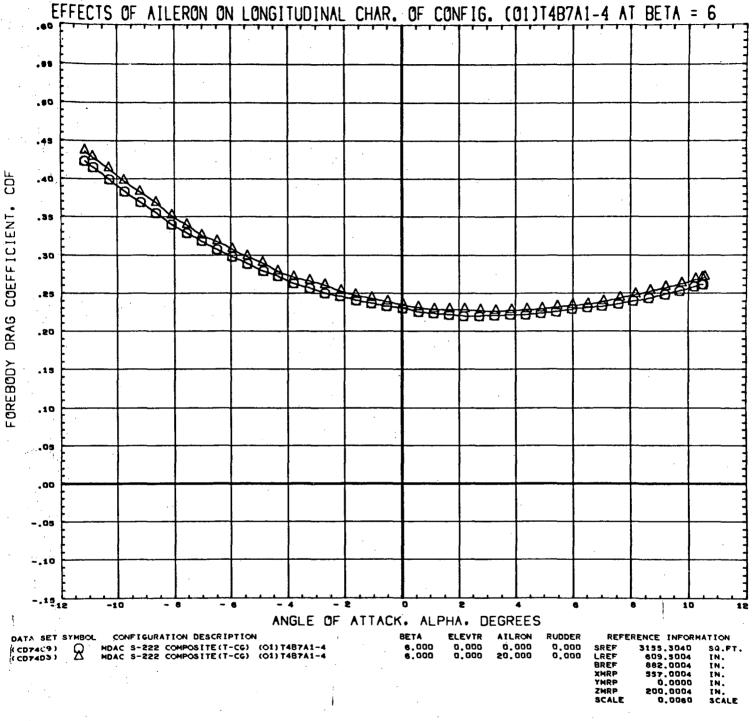
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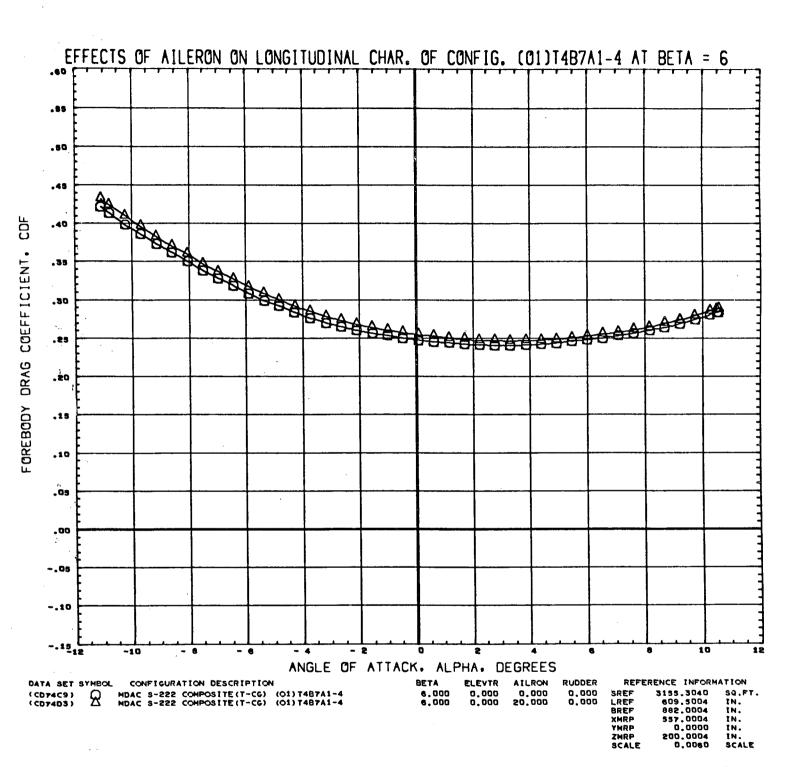


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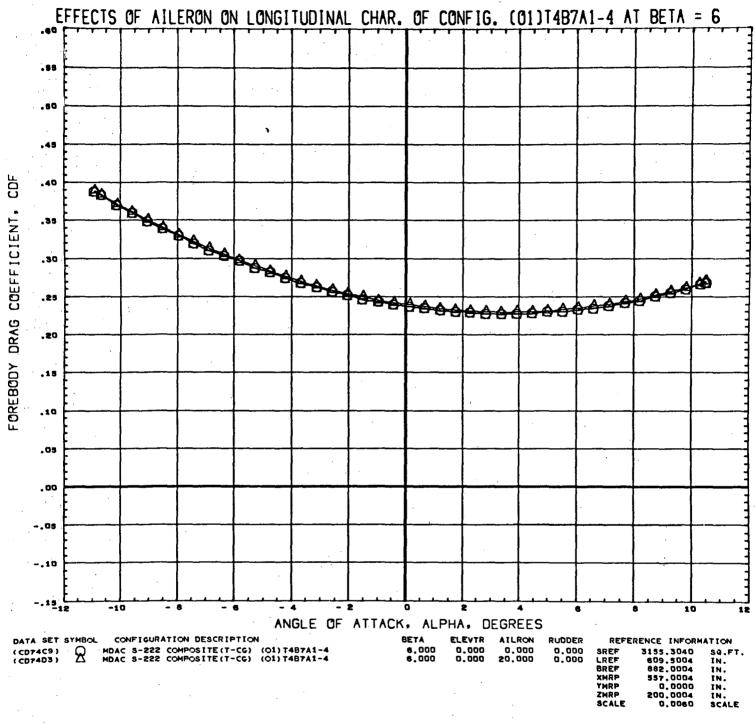


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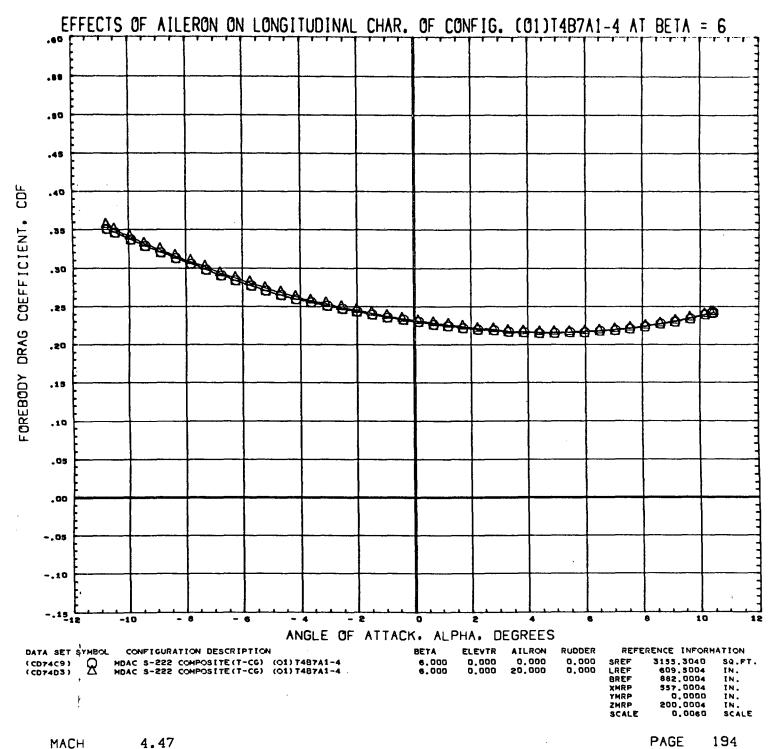


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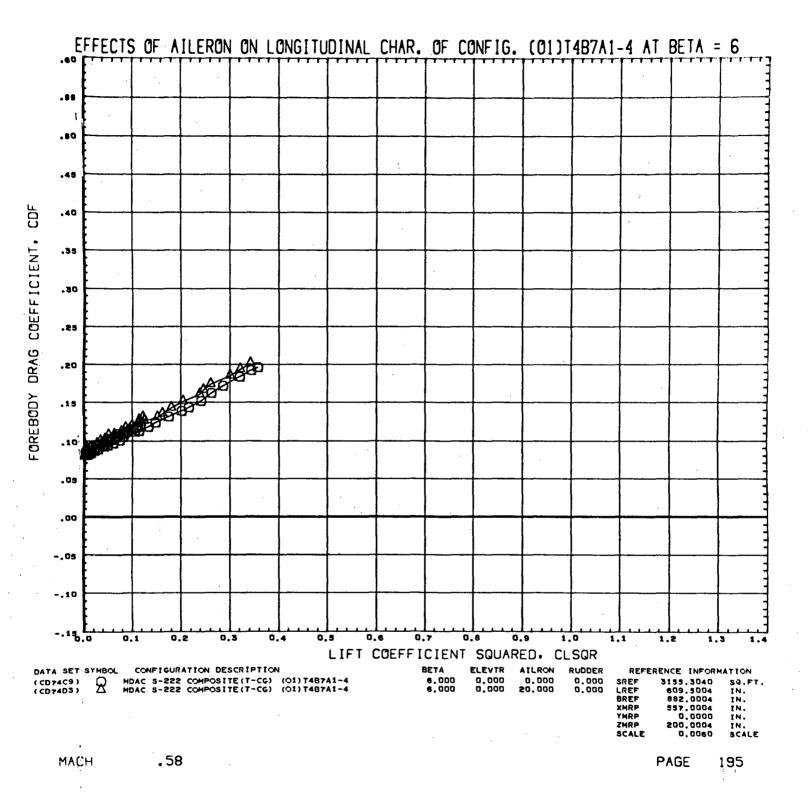
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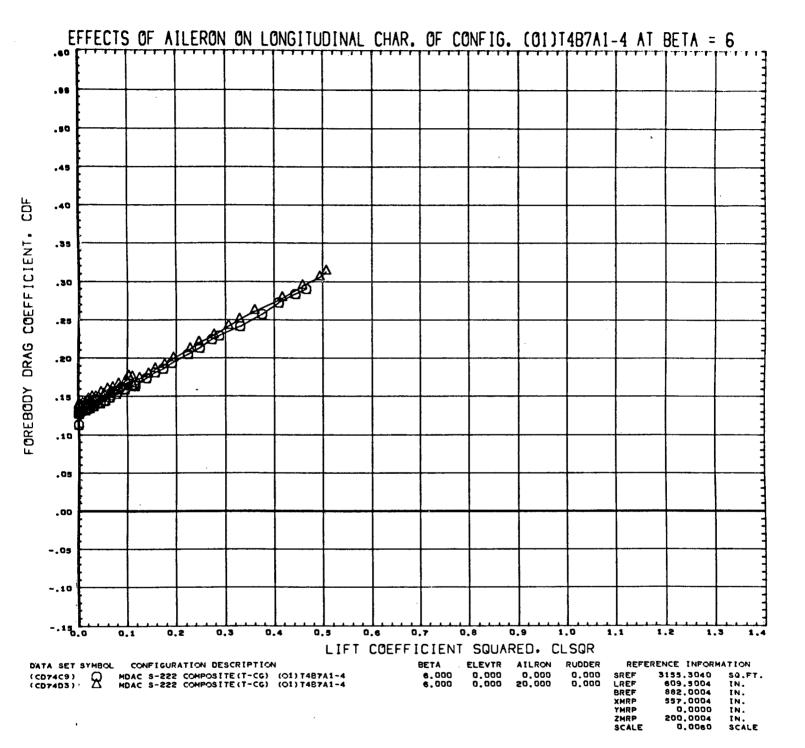


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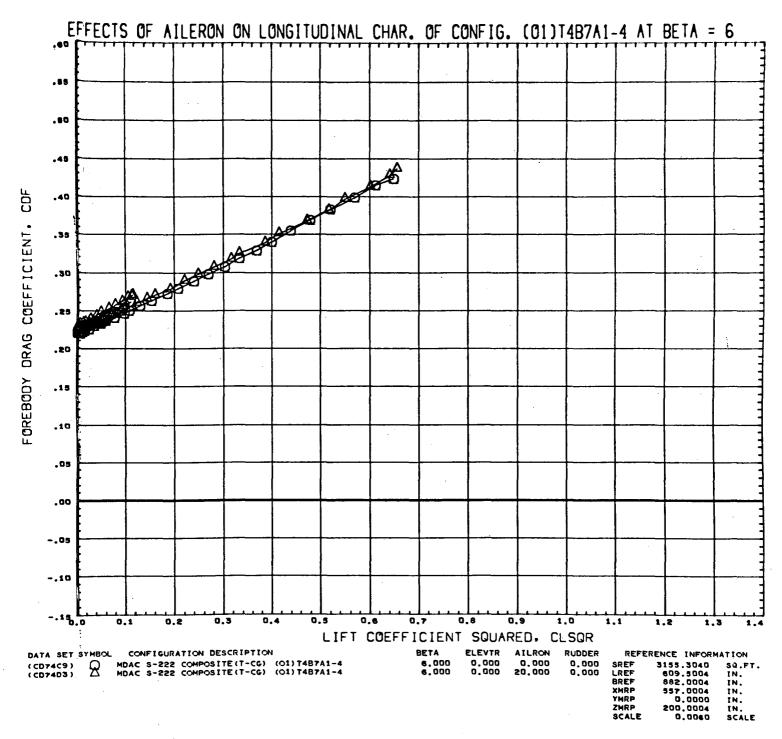


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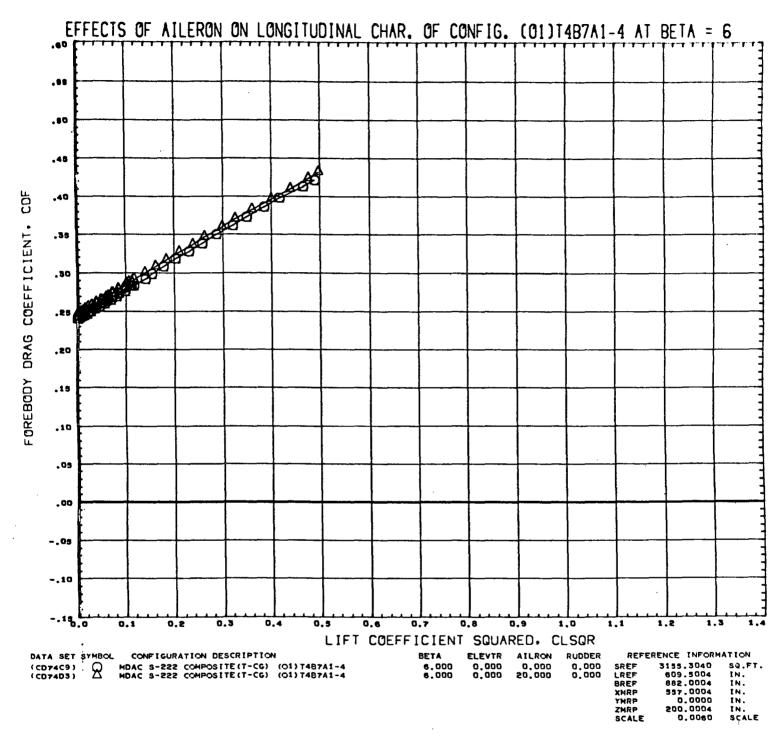




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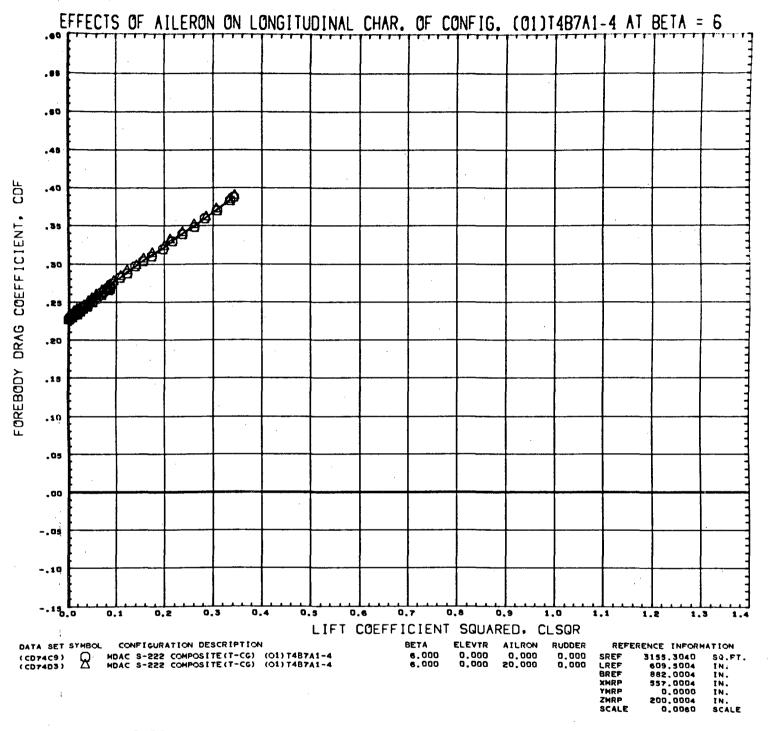


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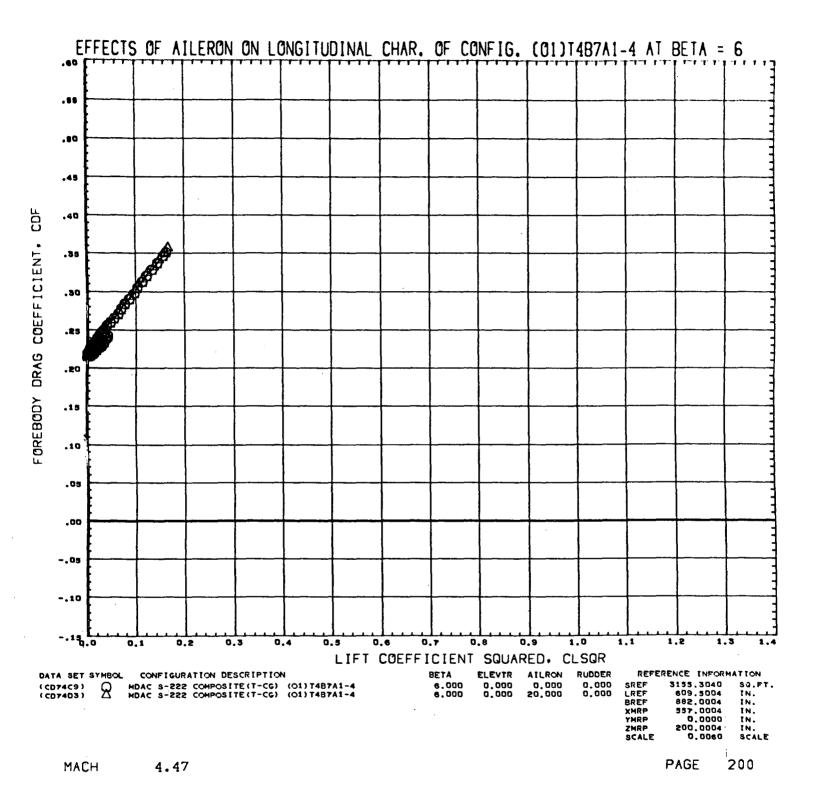


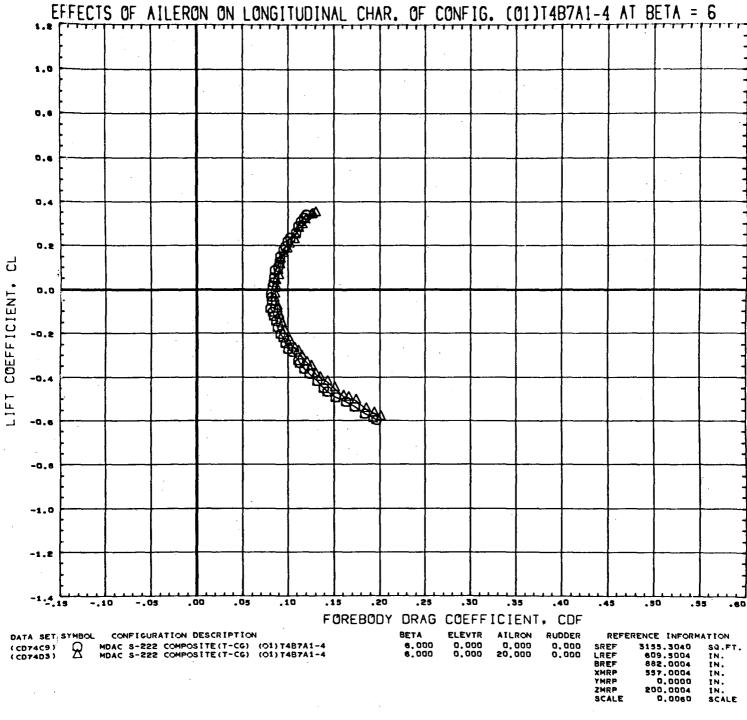
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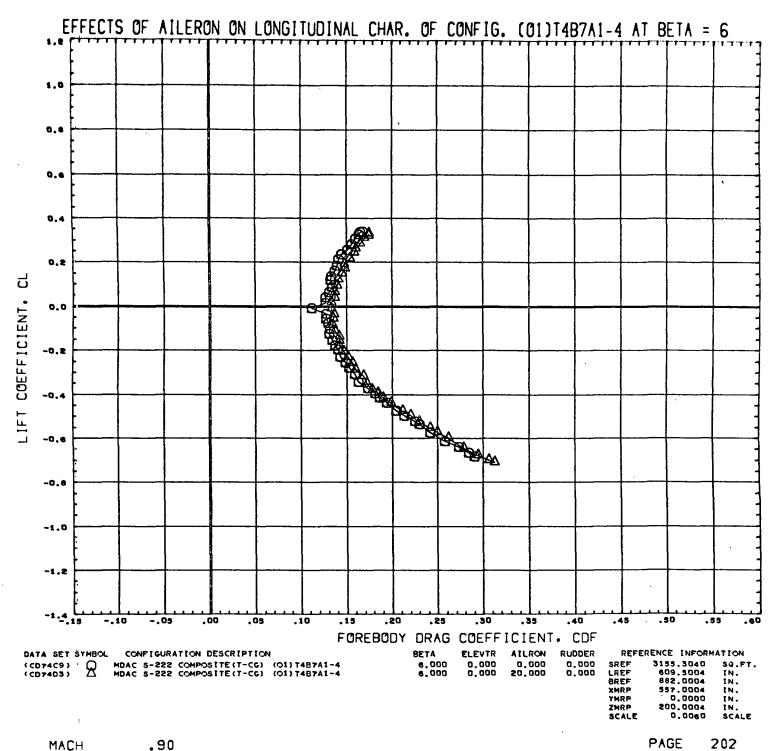


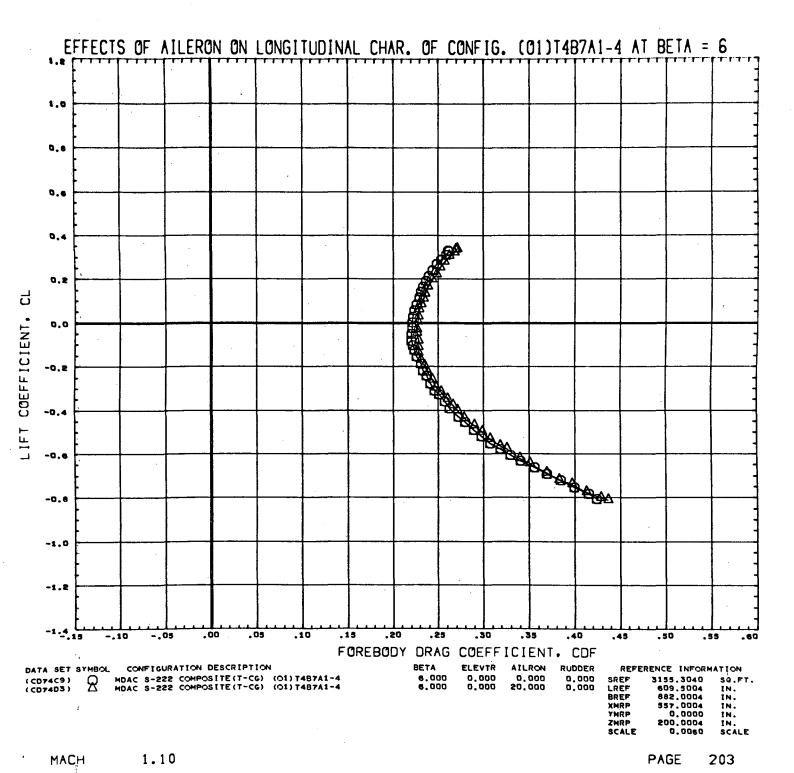
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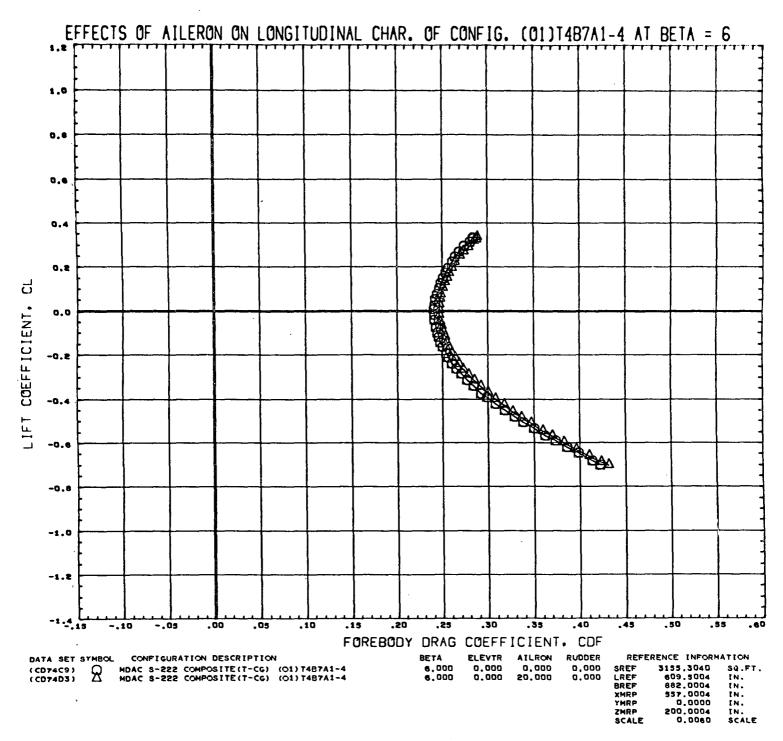


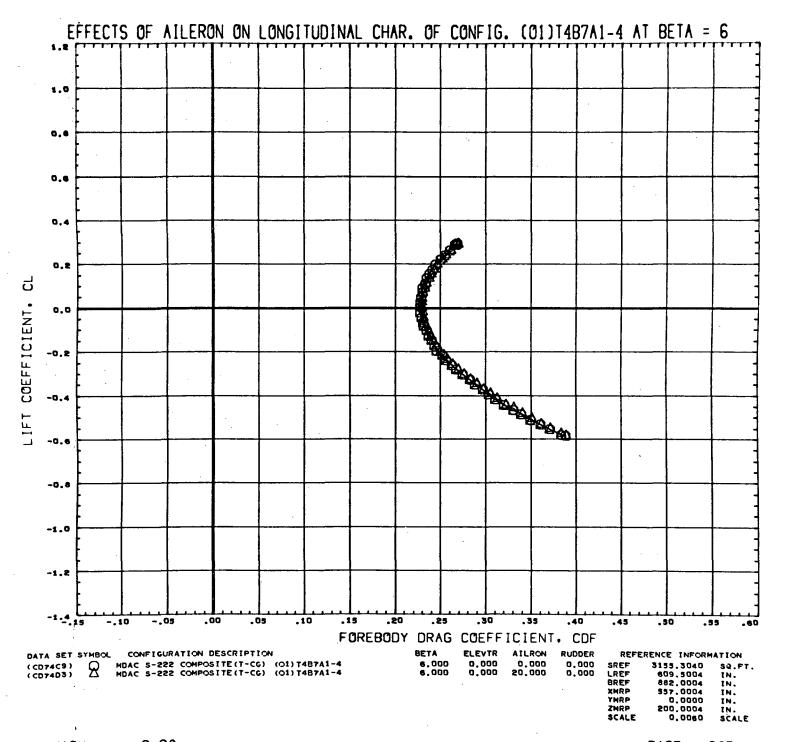


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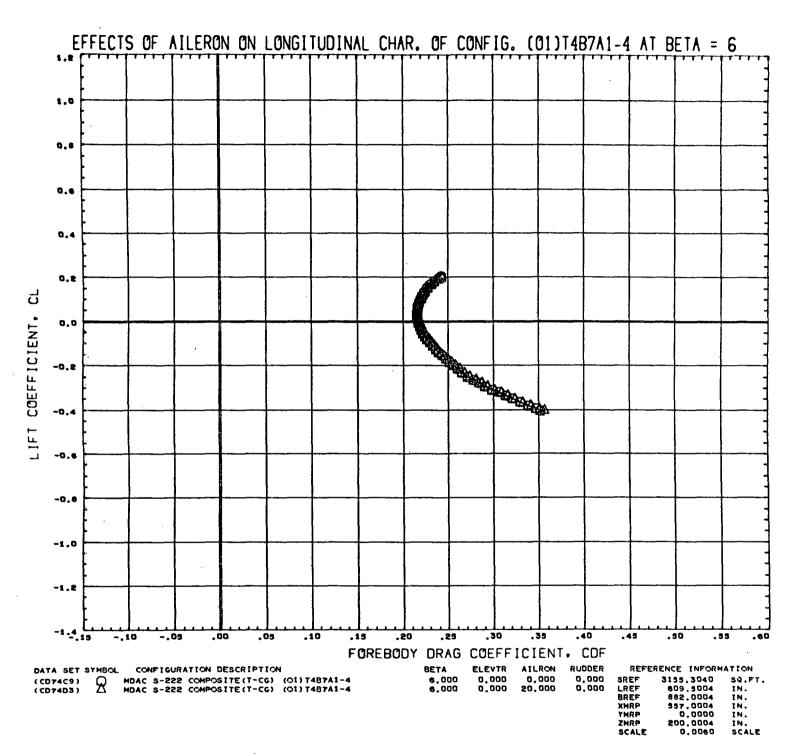




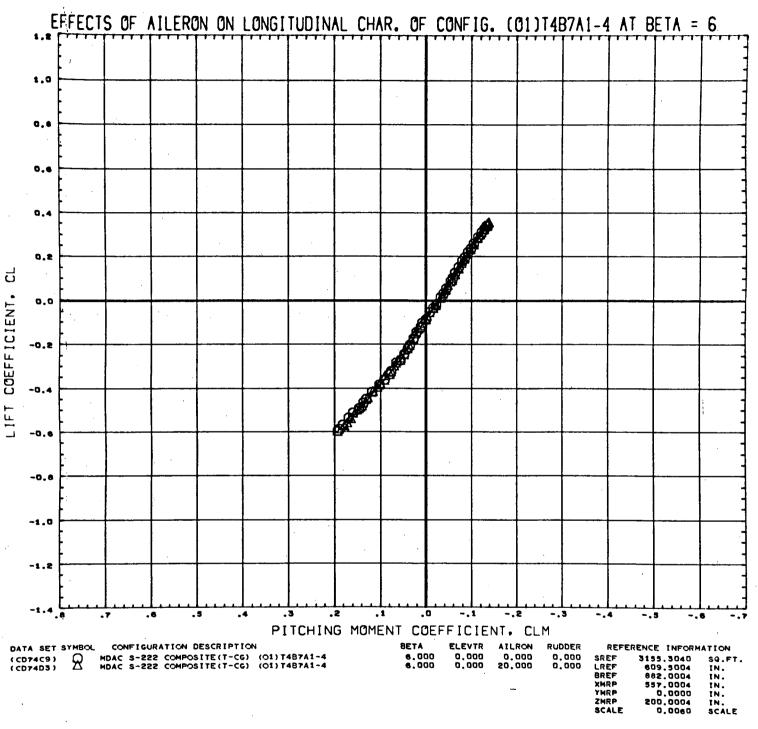




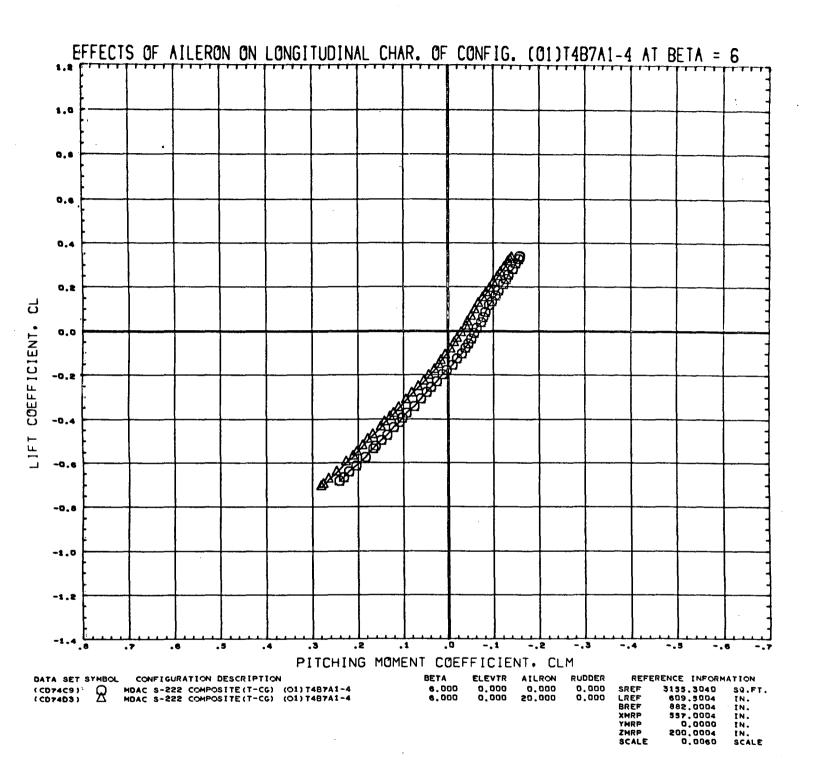
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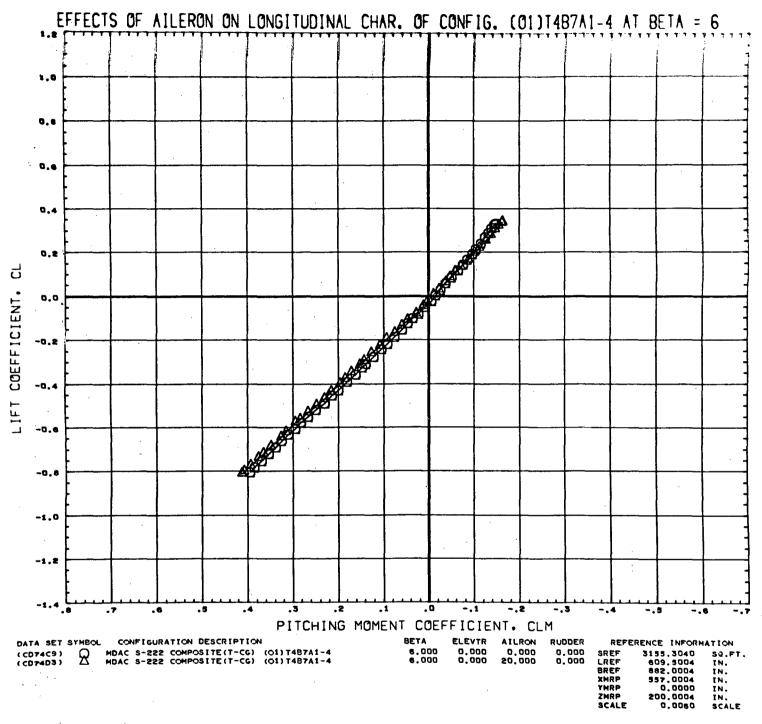
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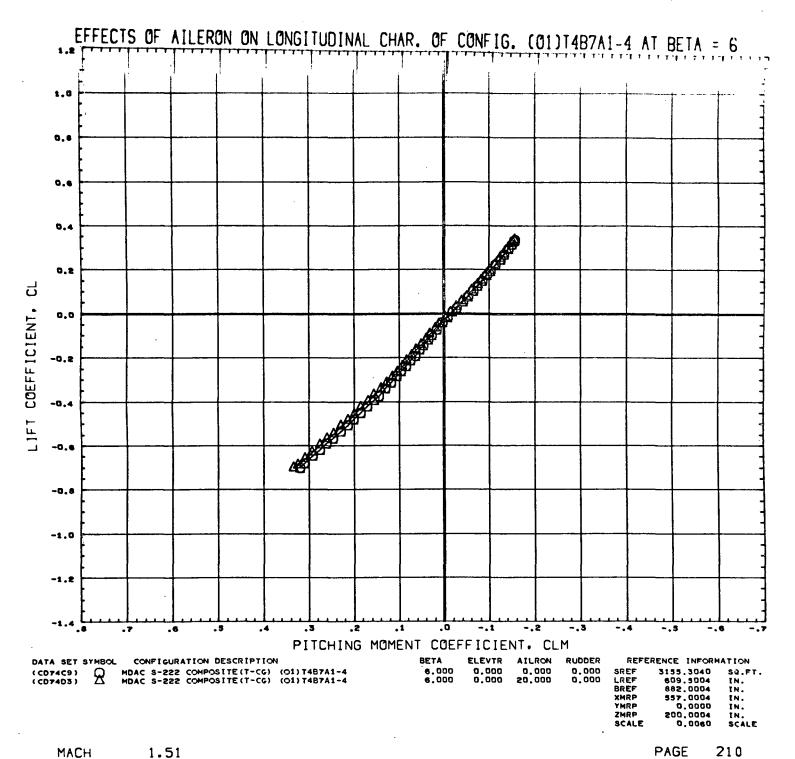
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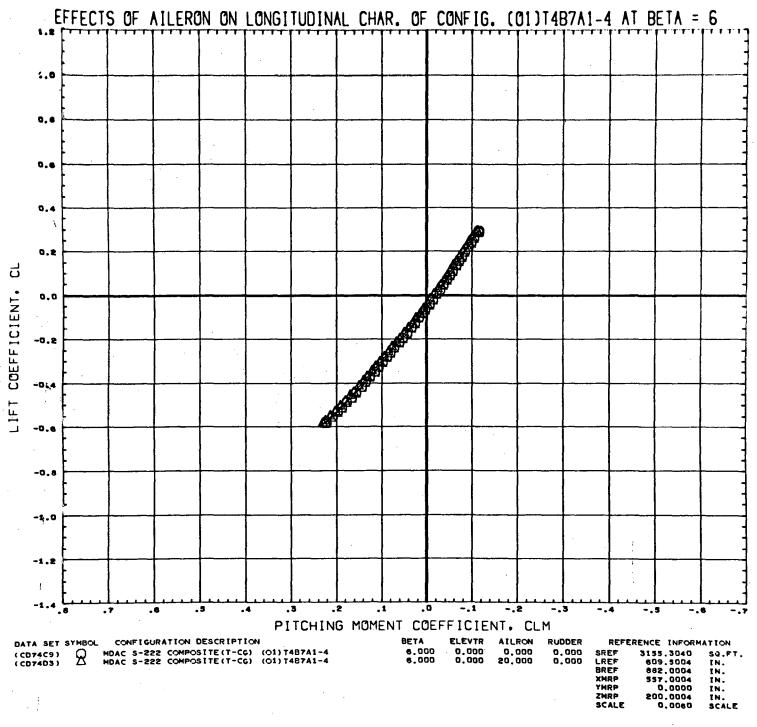


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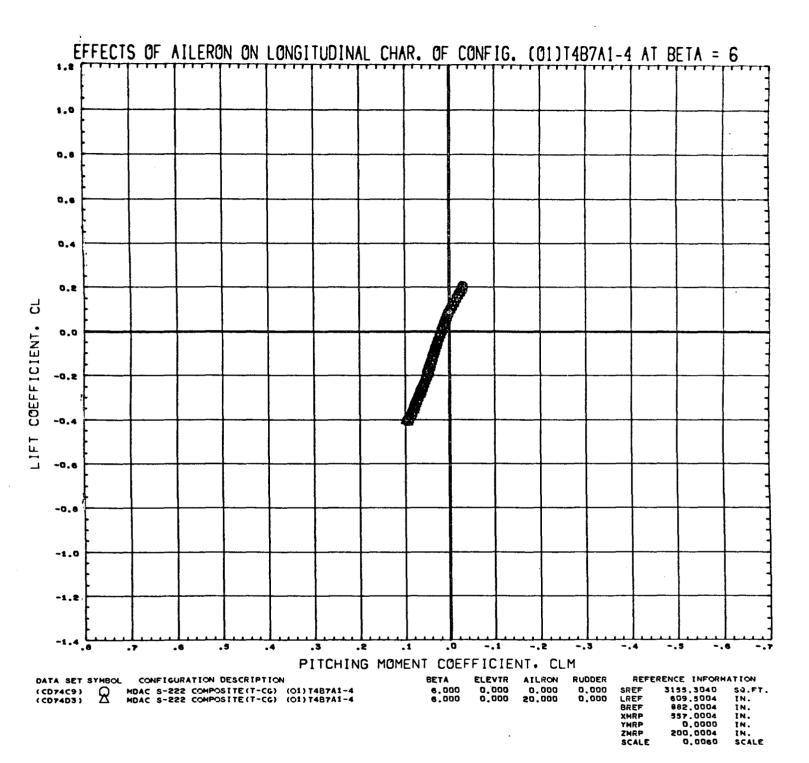


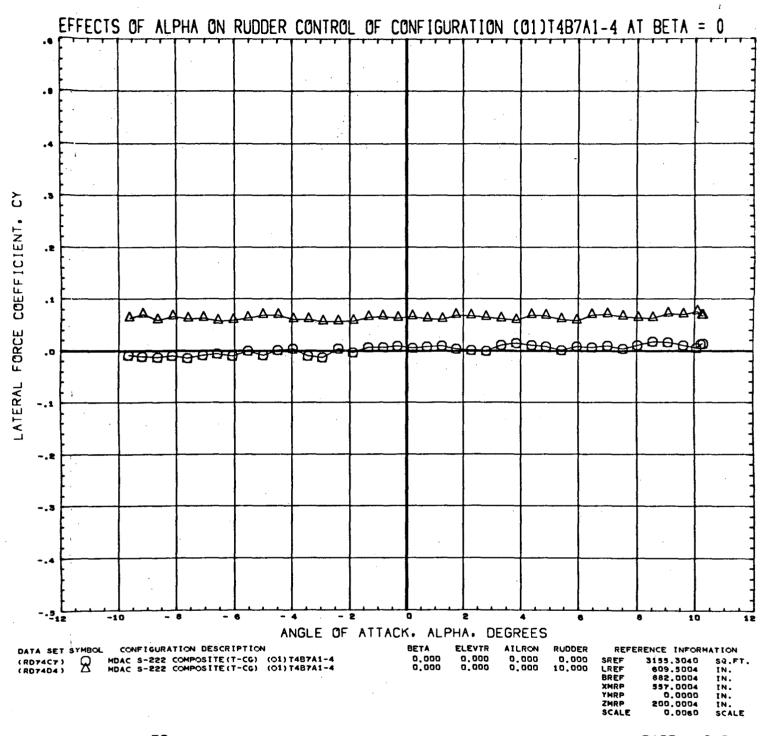
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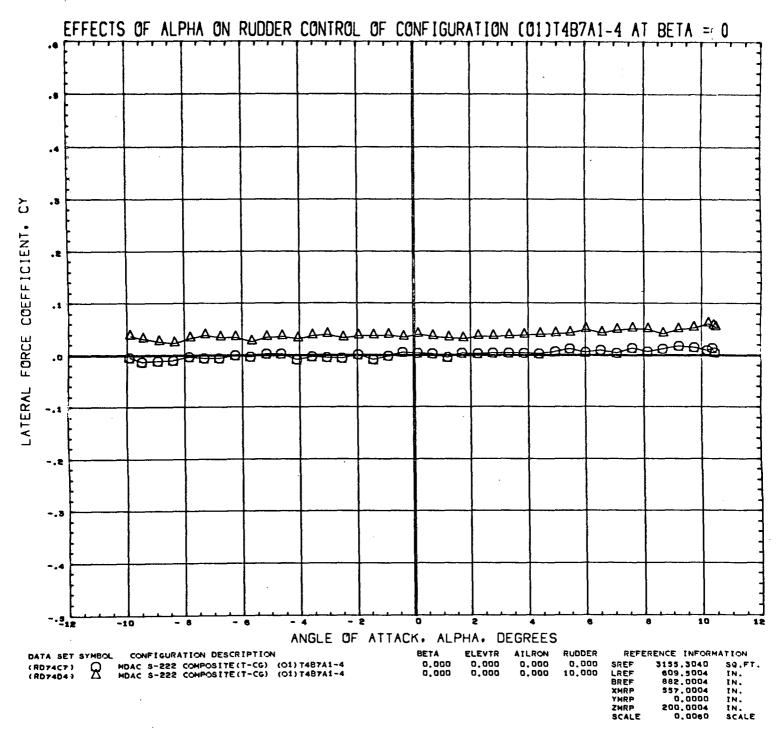


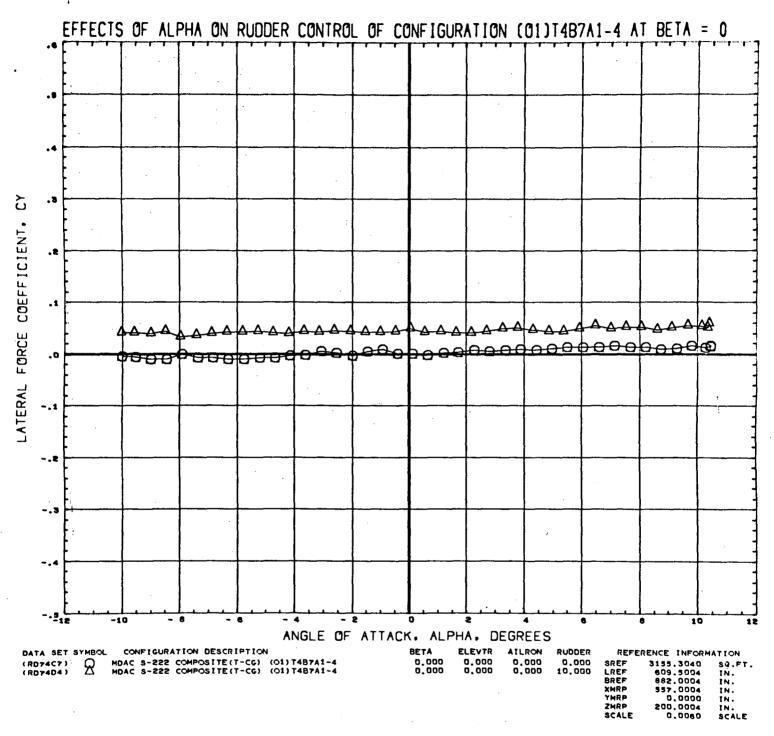
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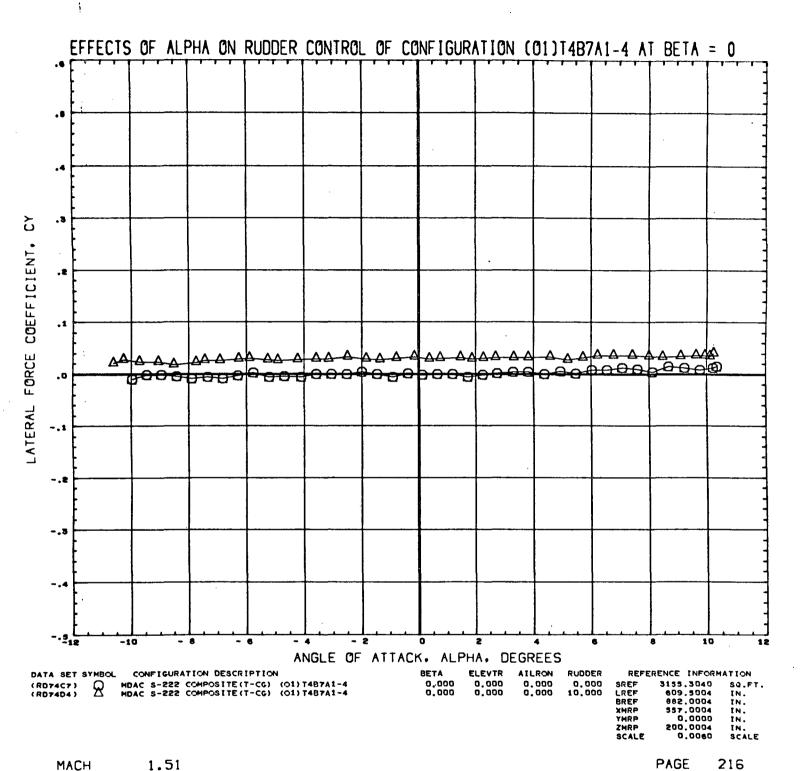


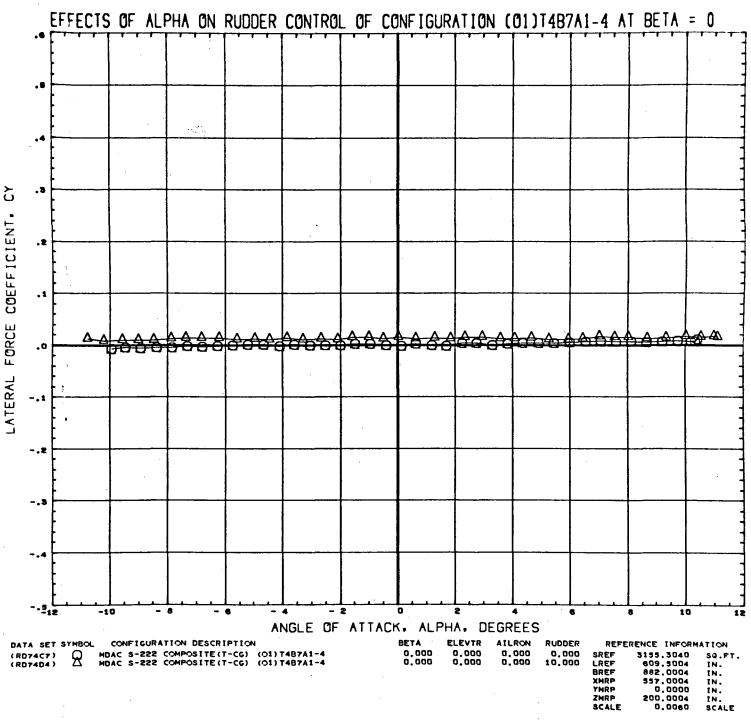
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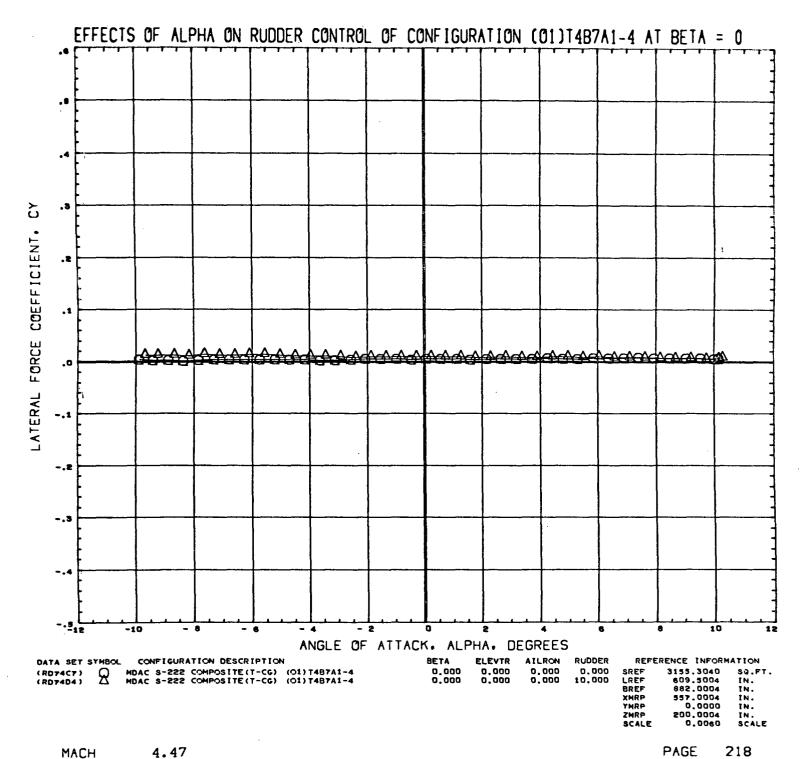


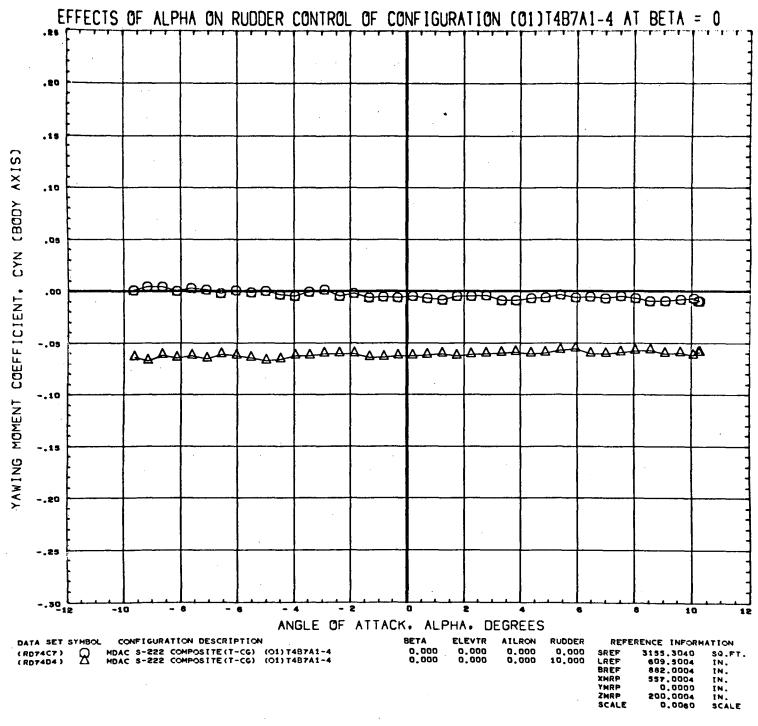
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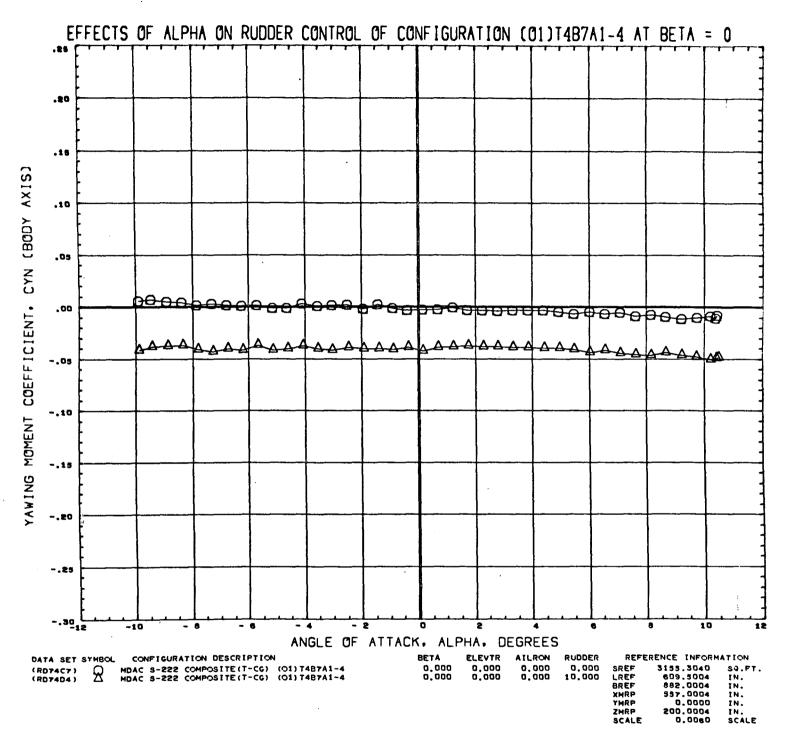


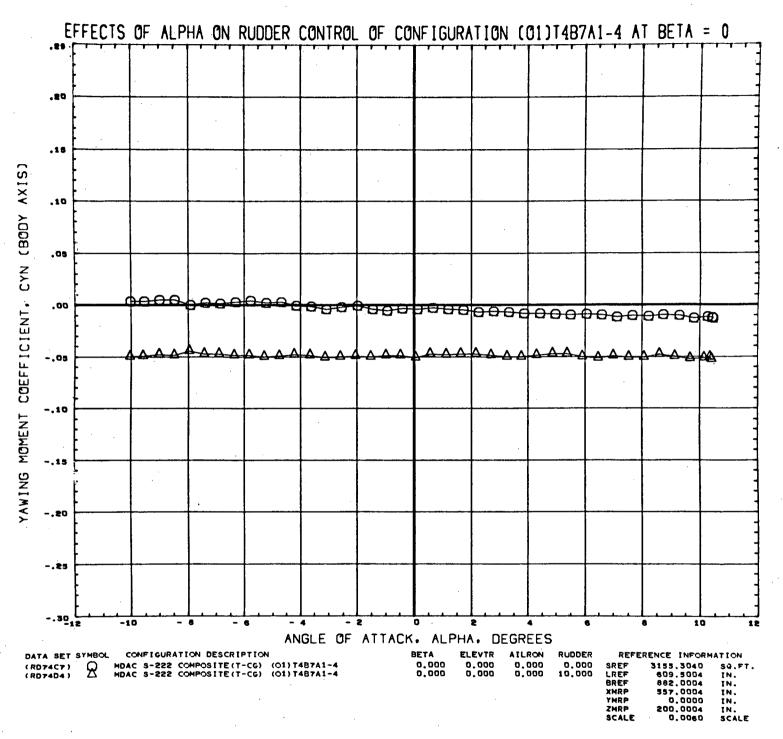
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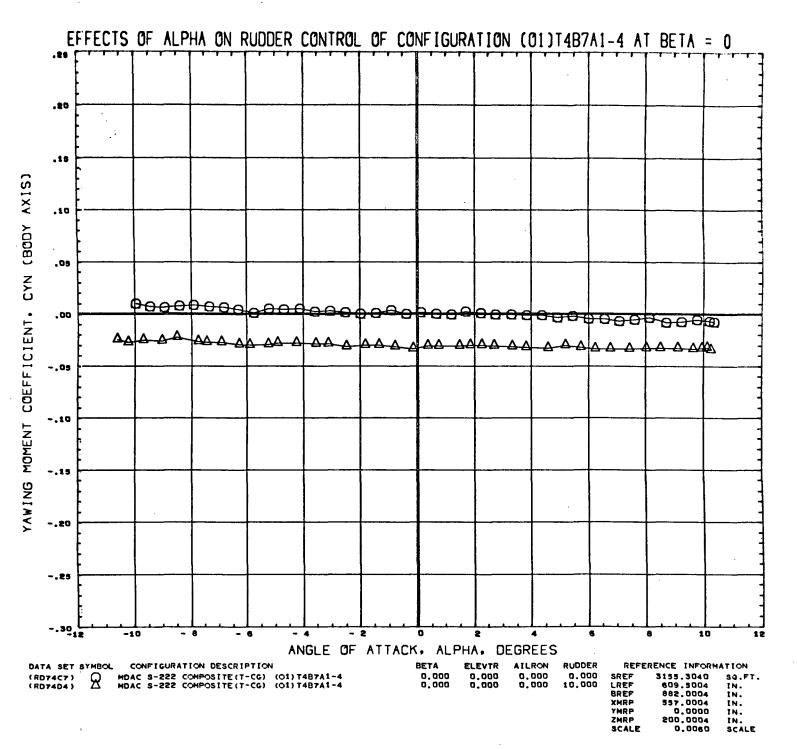


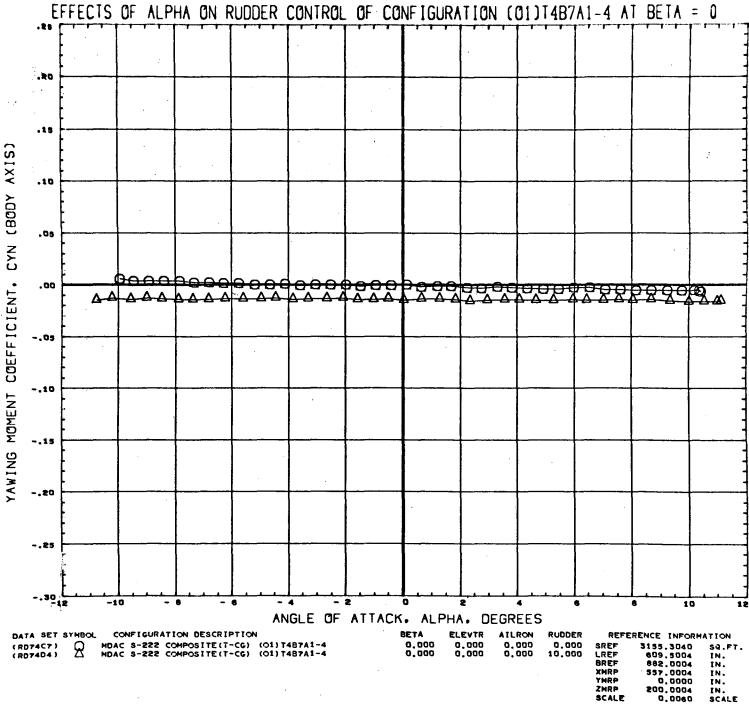
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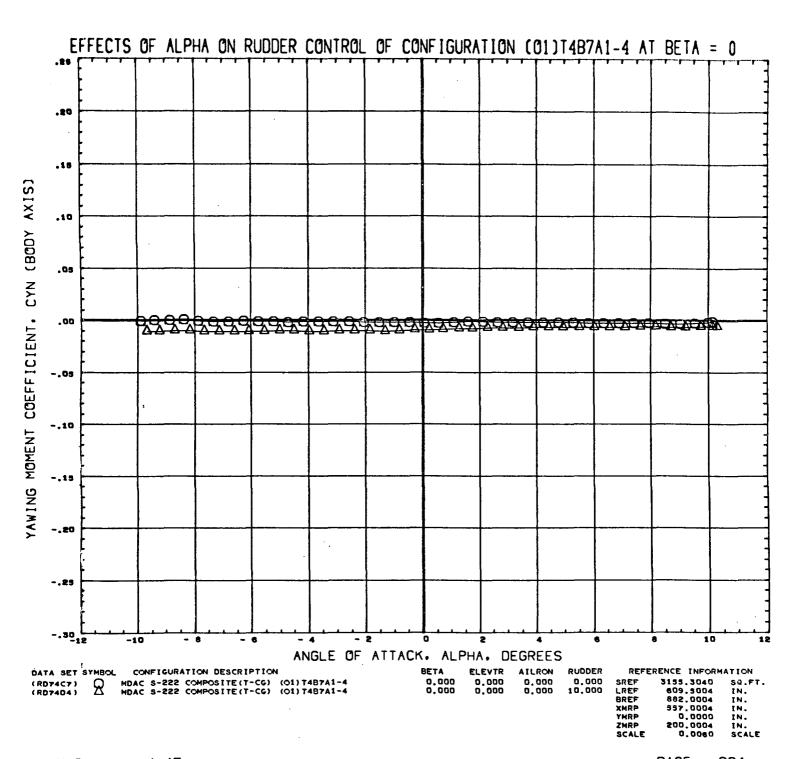


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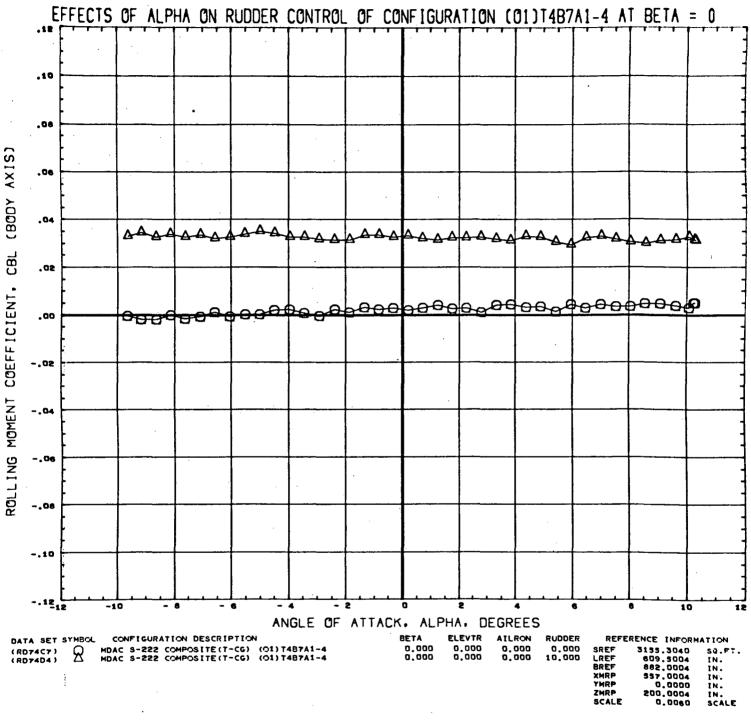




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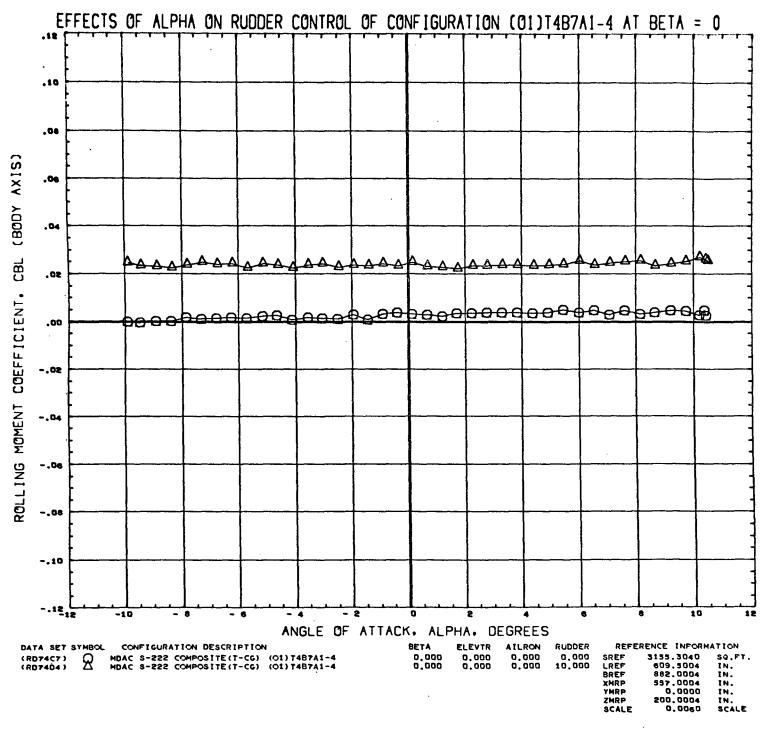
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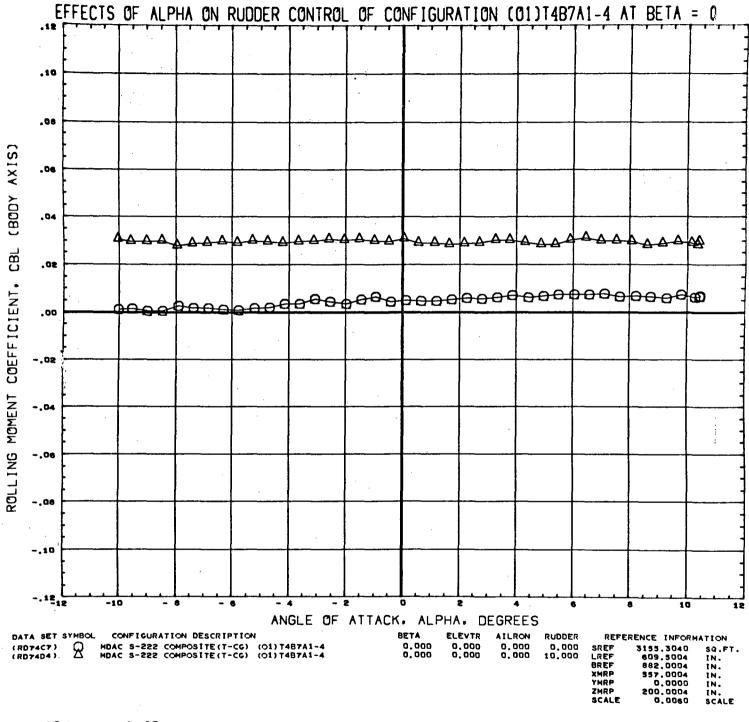


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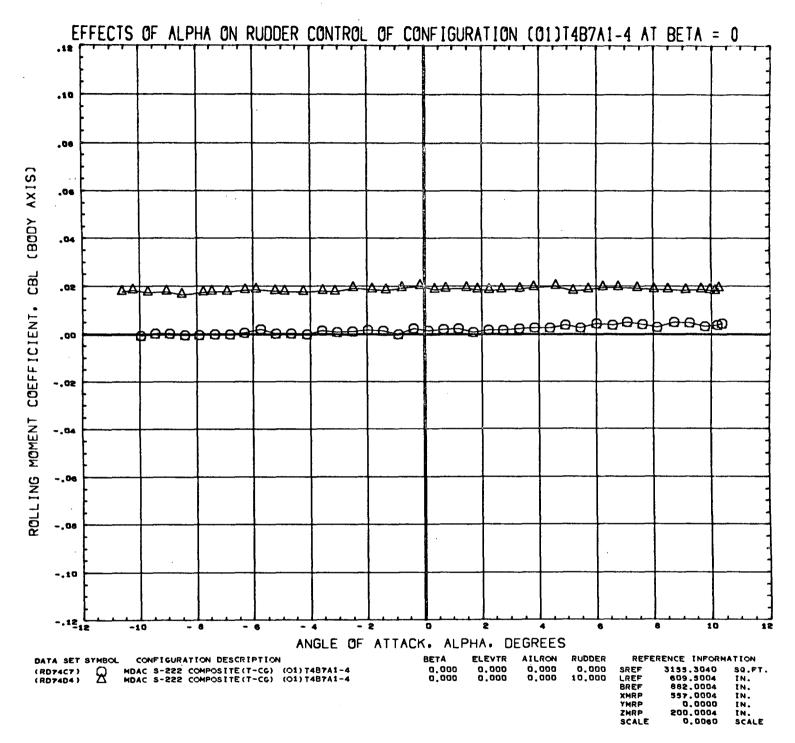
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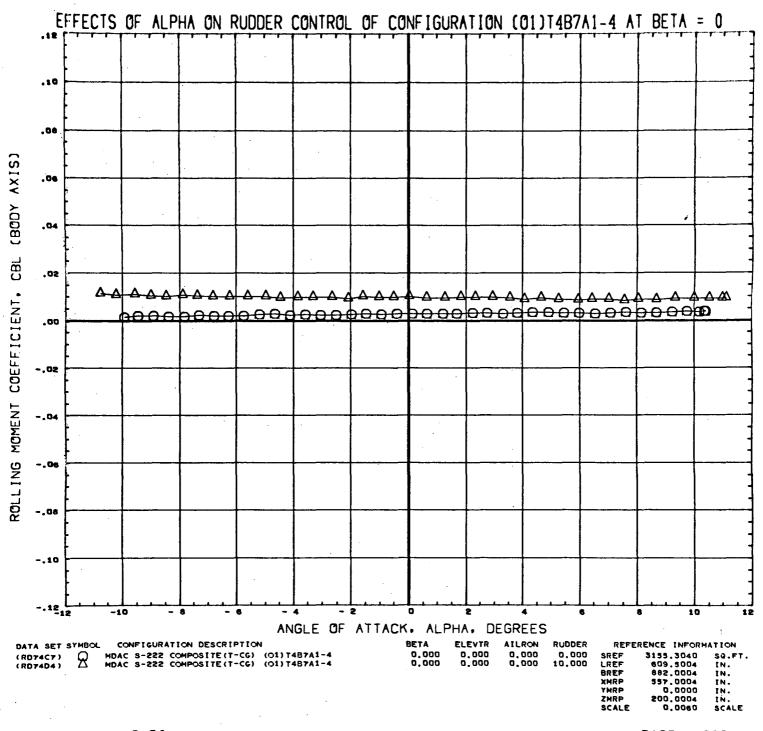
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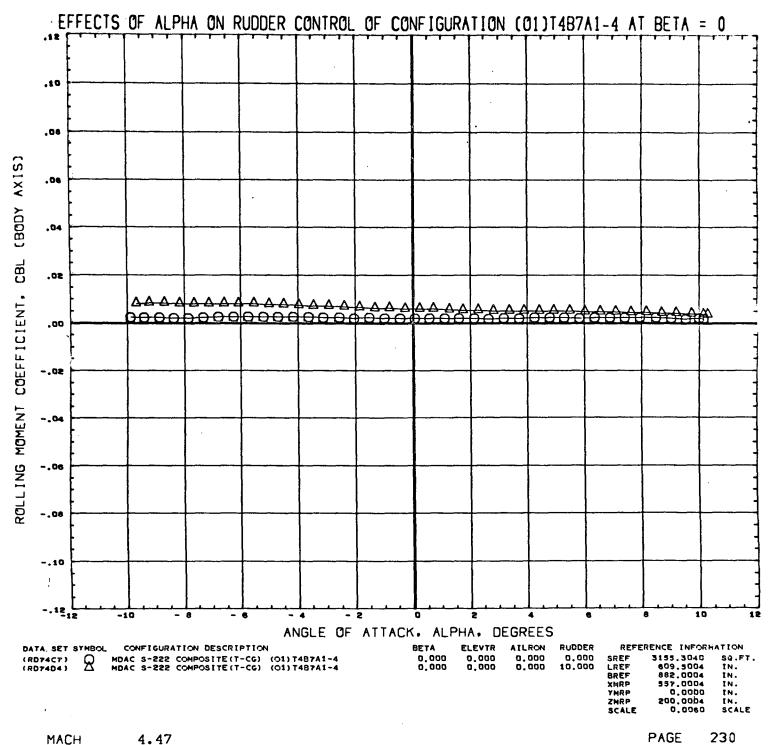


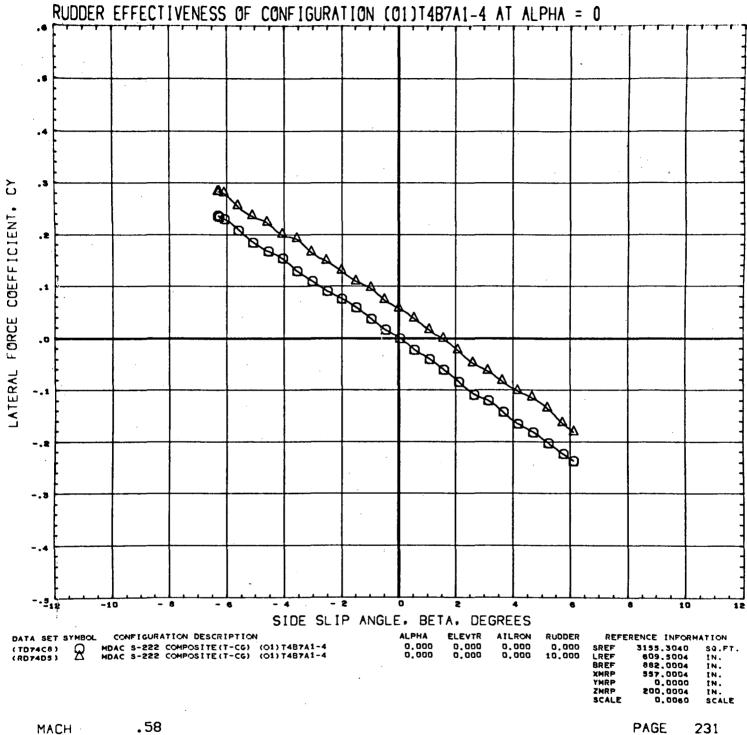
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MACH 2.20

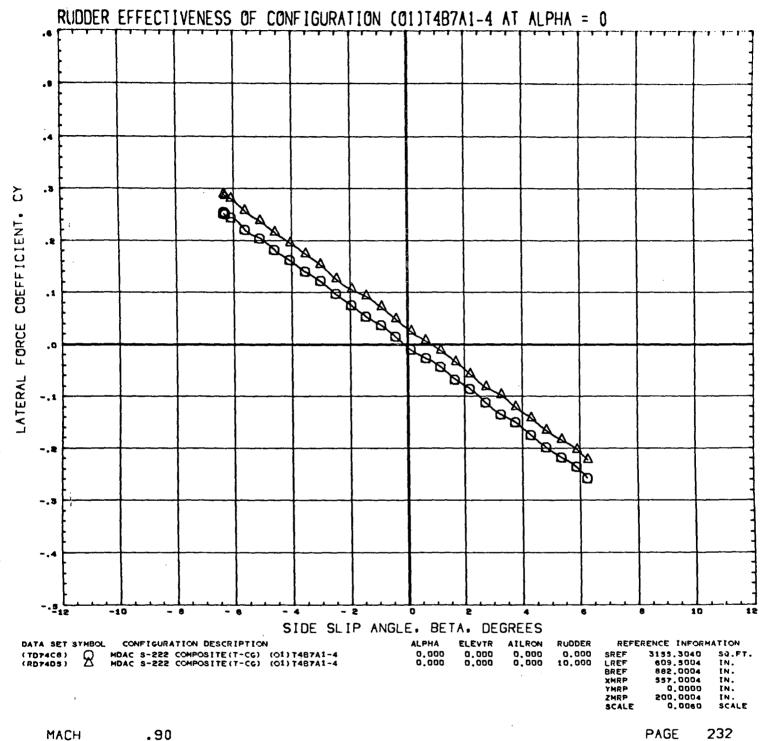


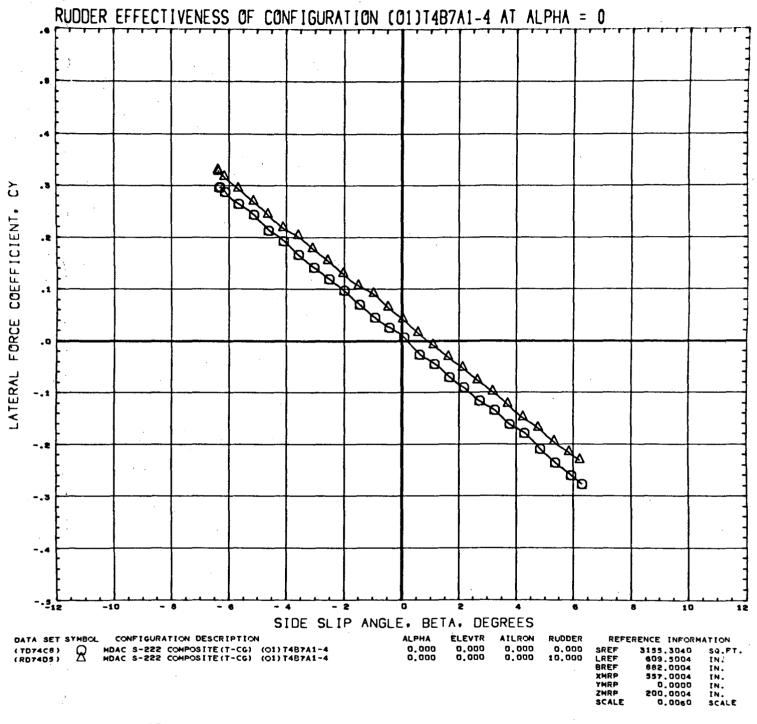


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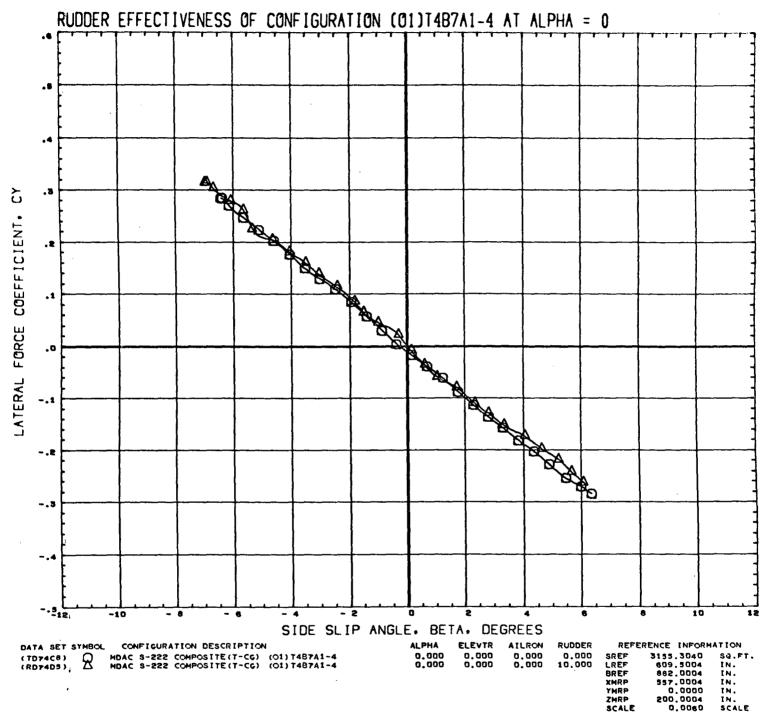
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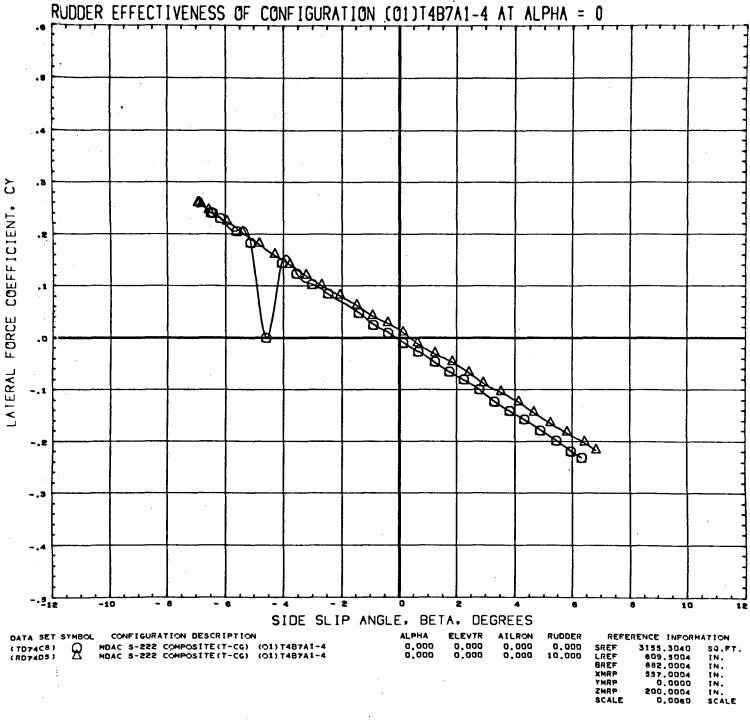


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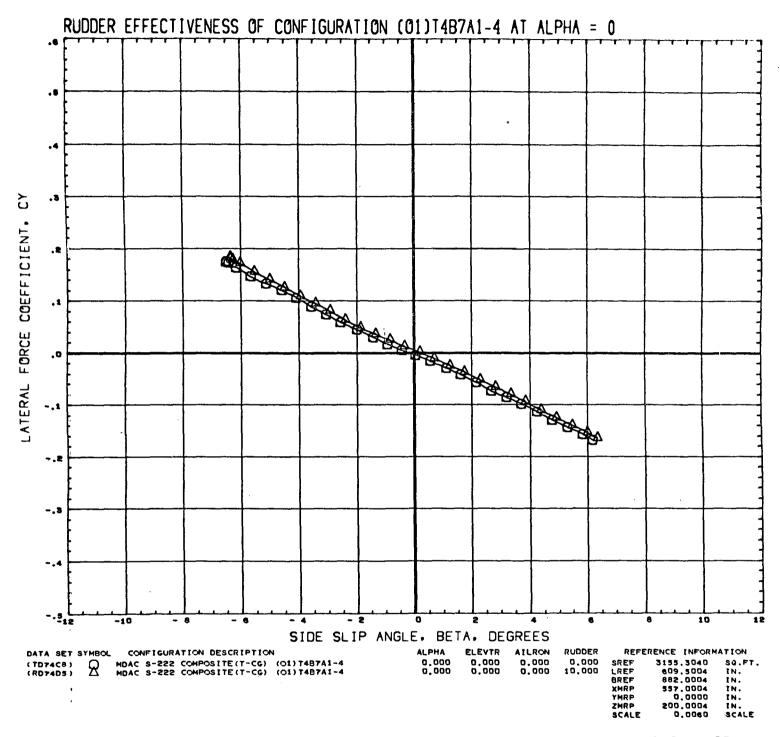


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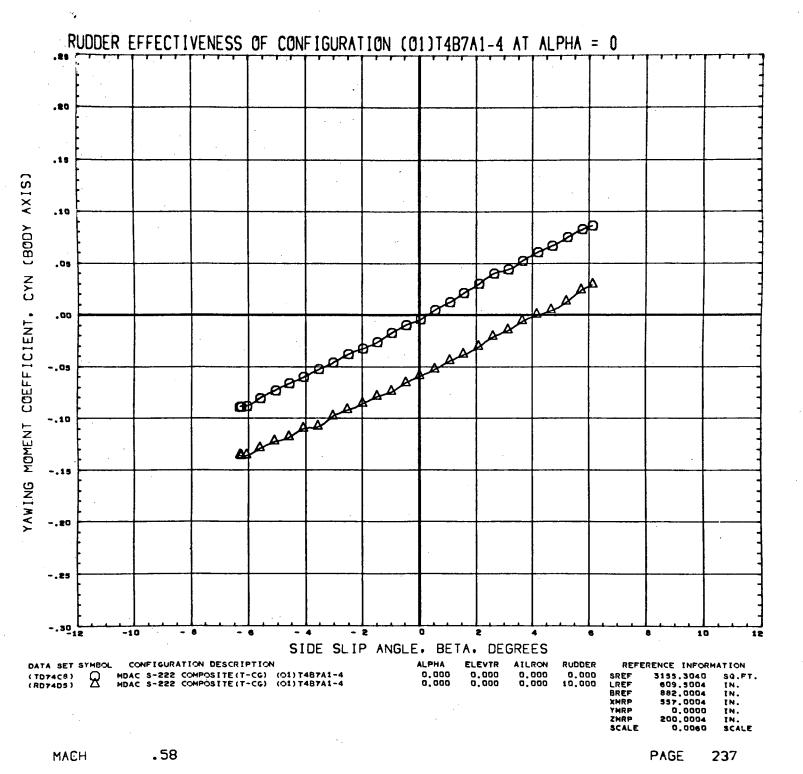
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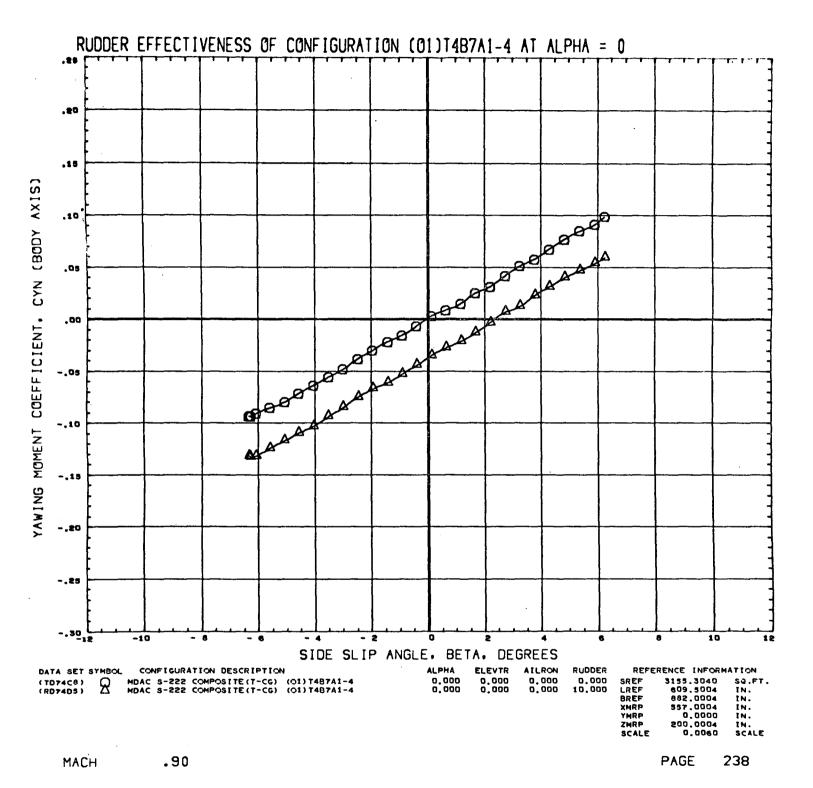


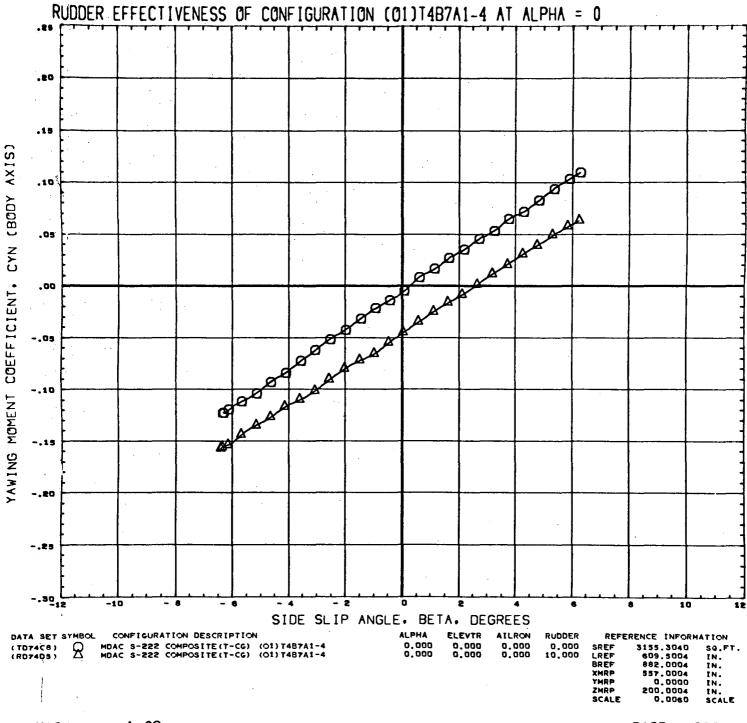
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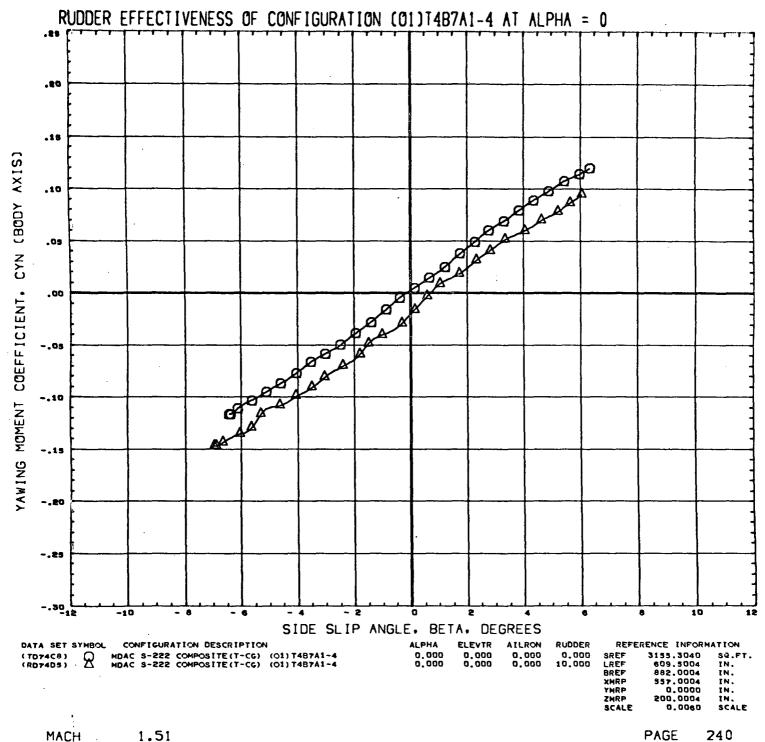
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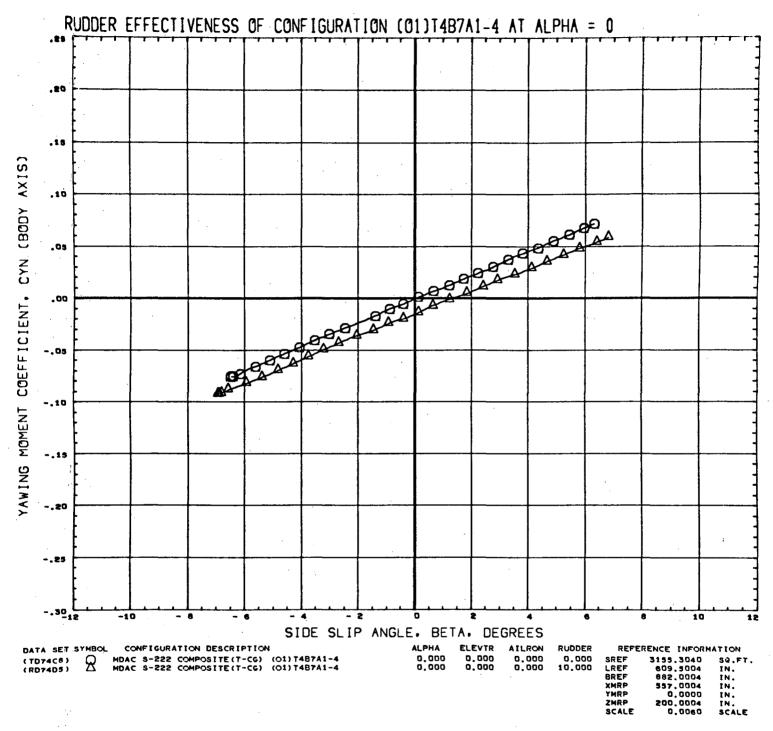




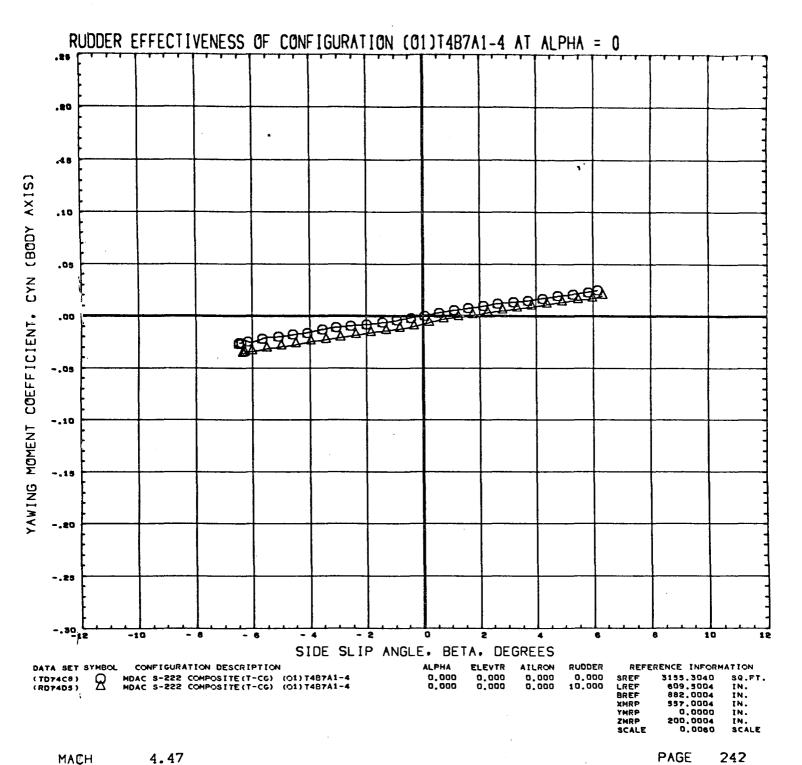


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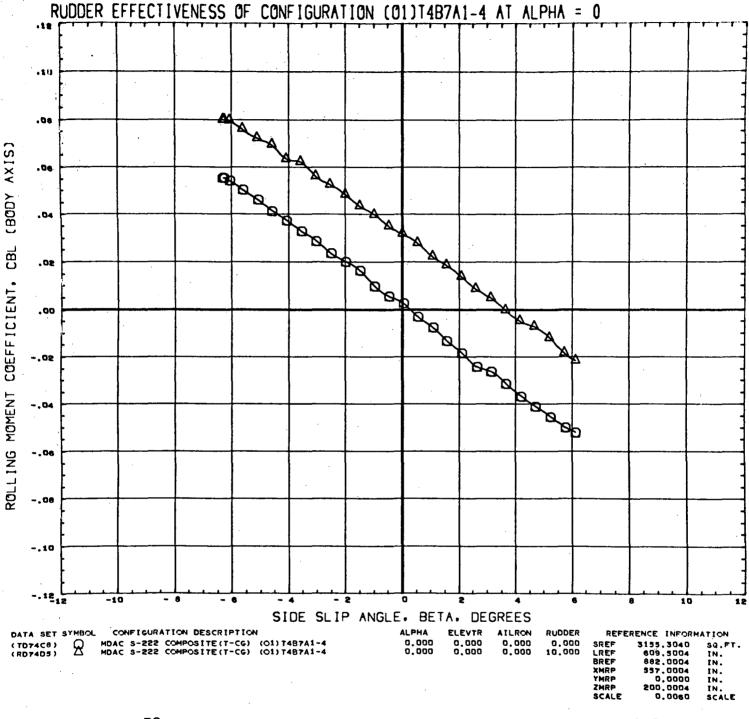




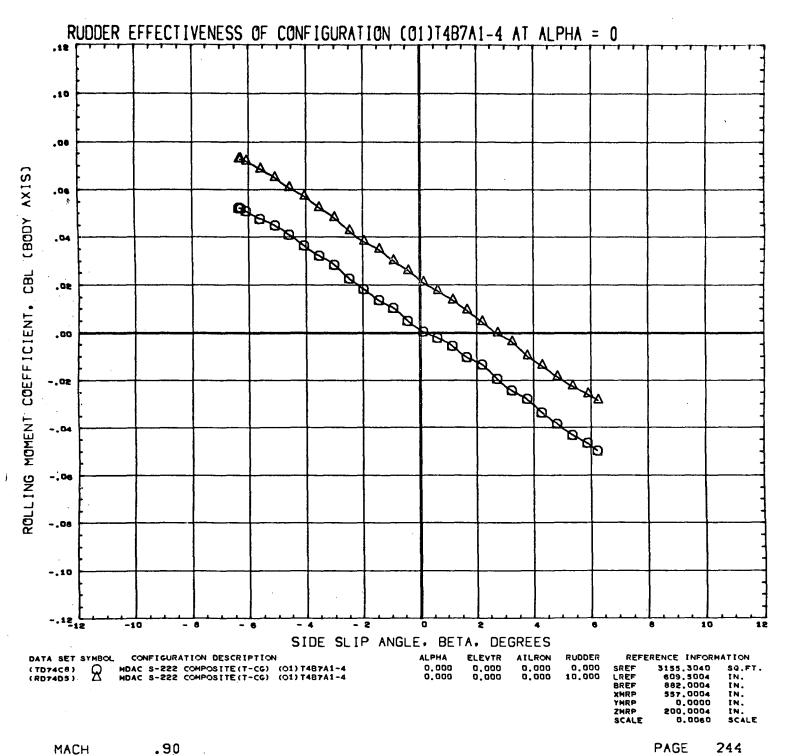
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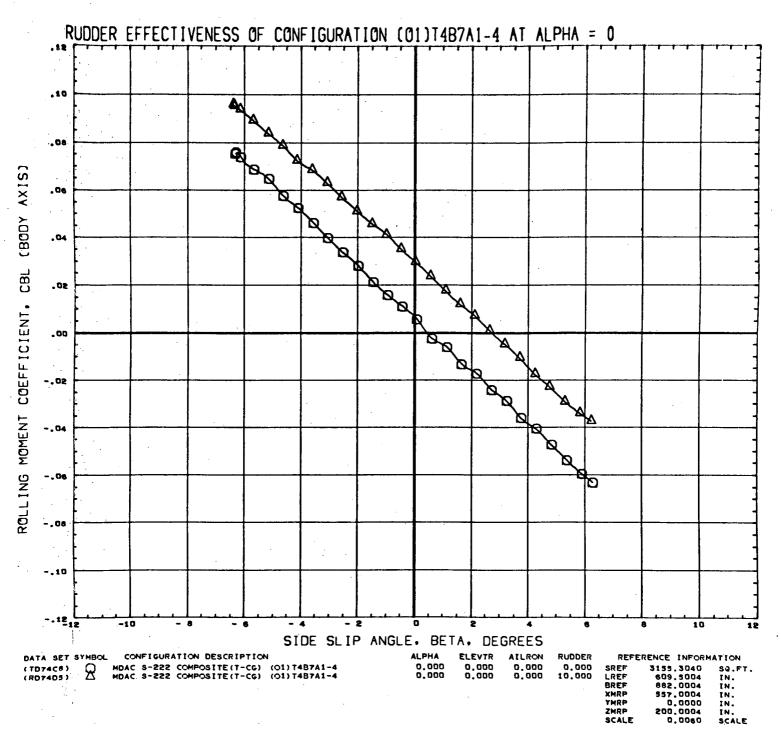


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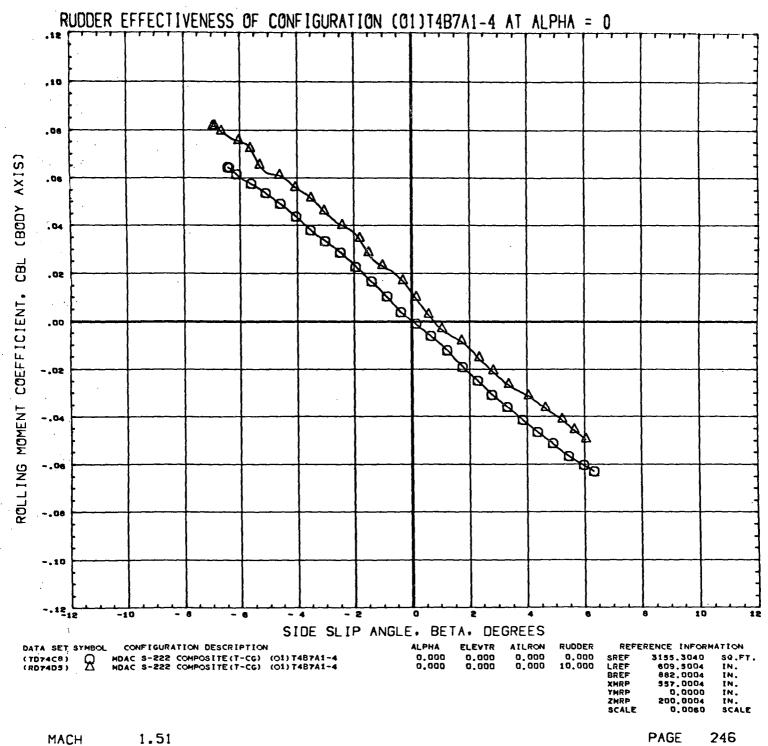


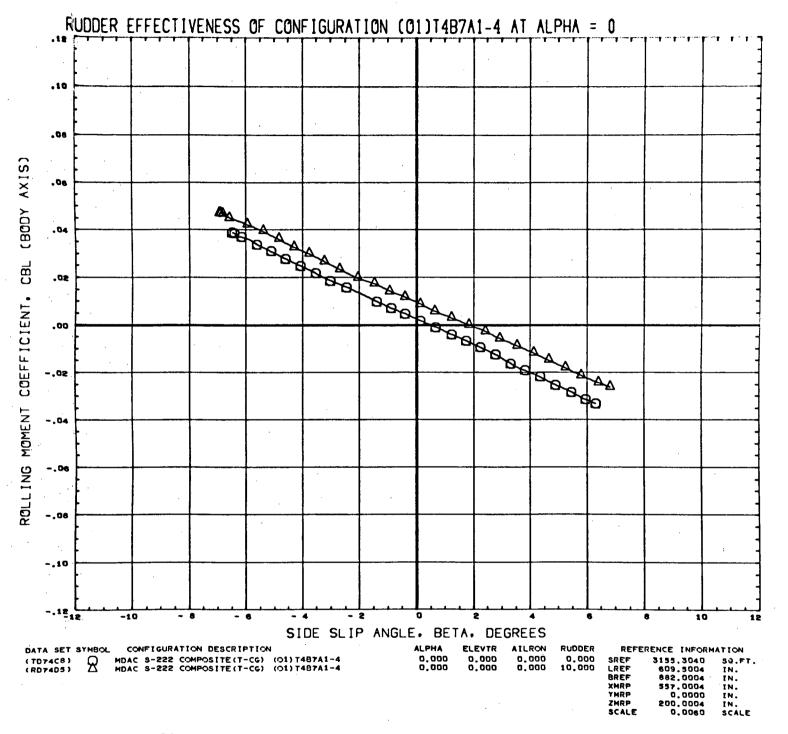
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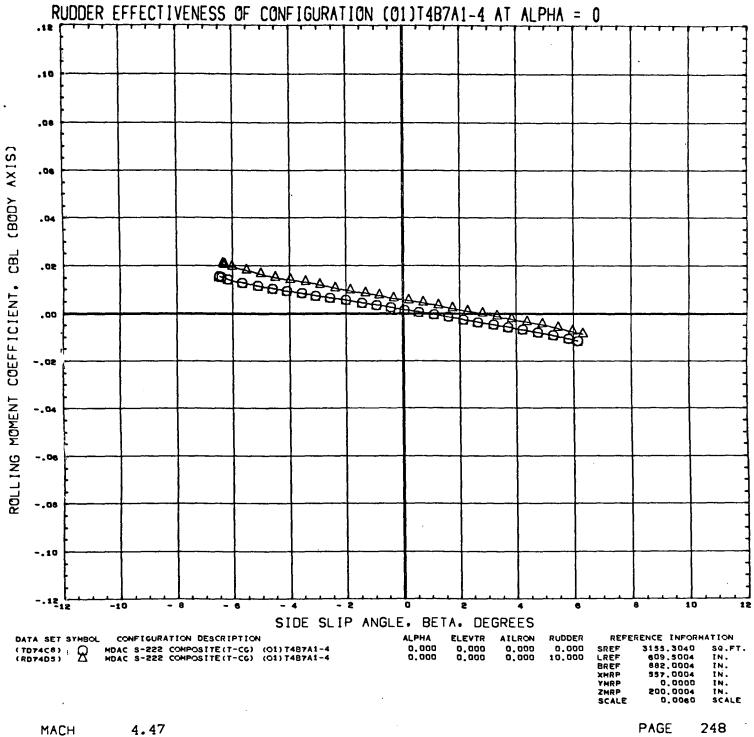


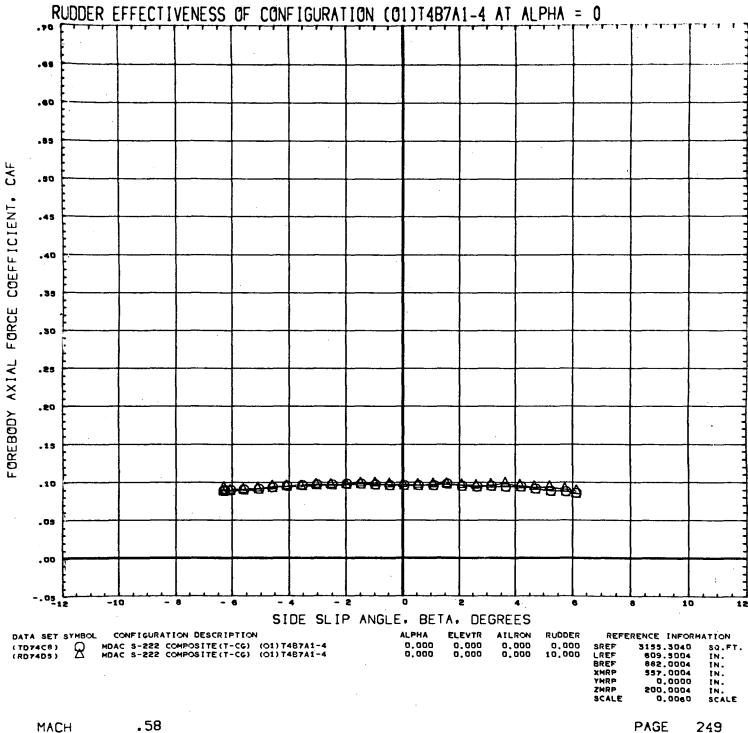
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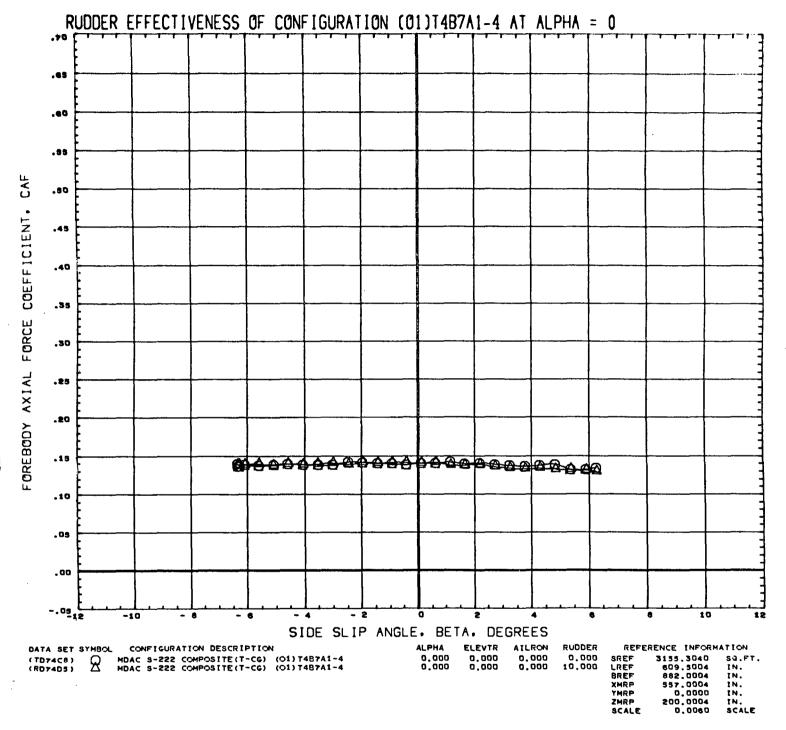
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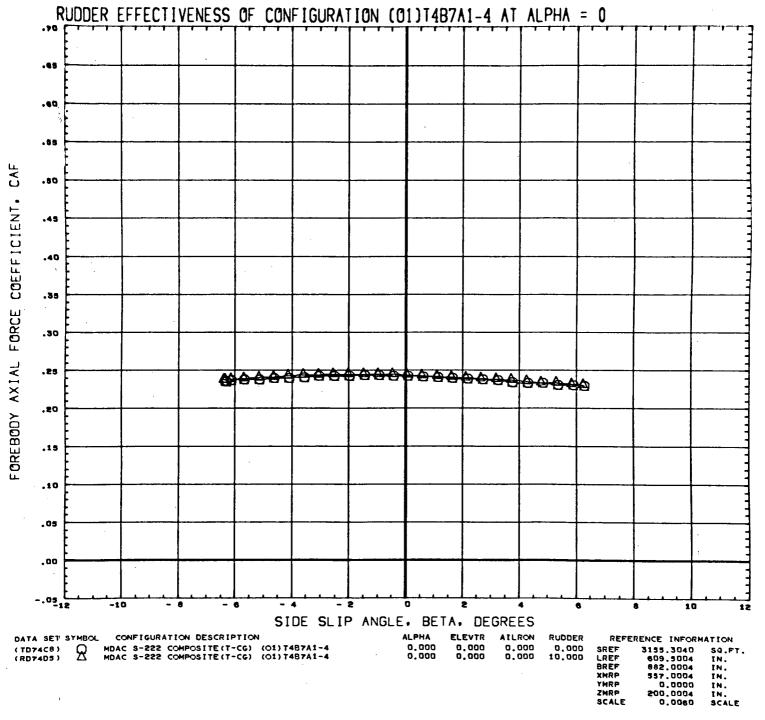
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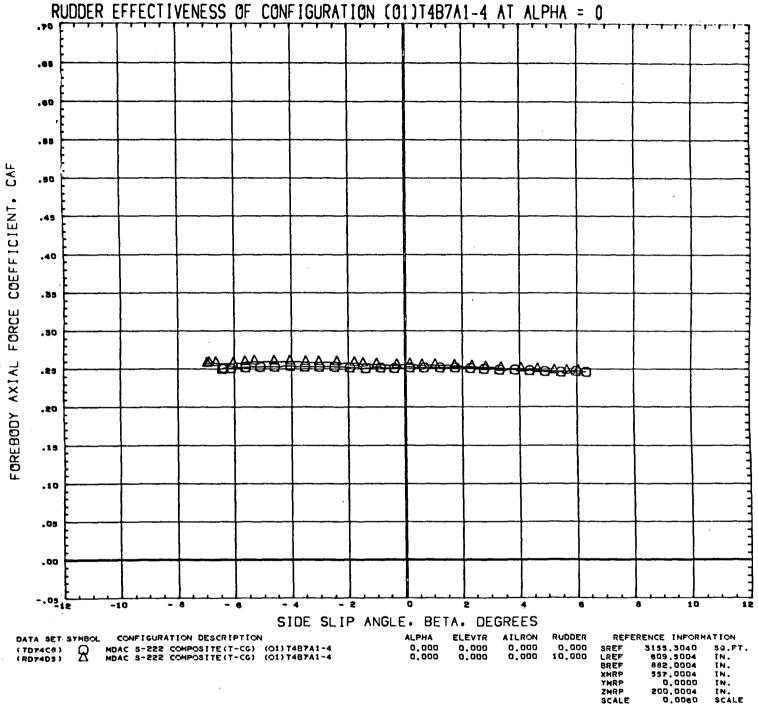
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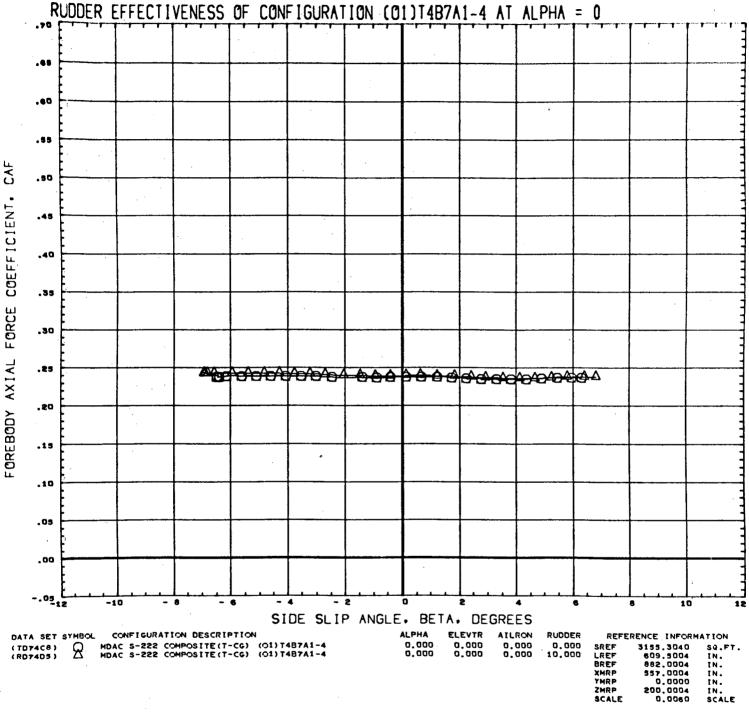
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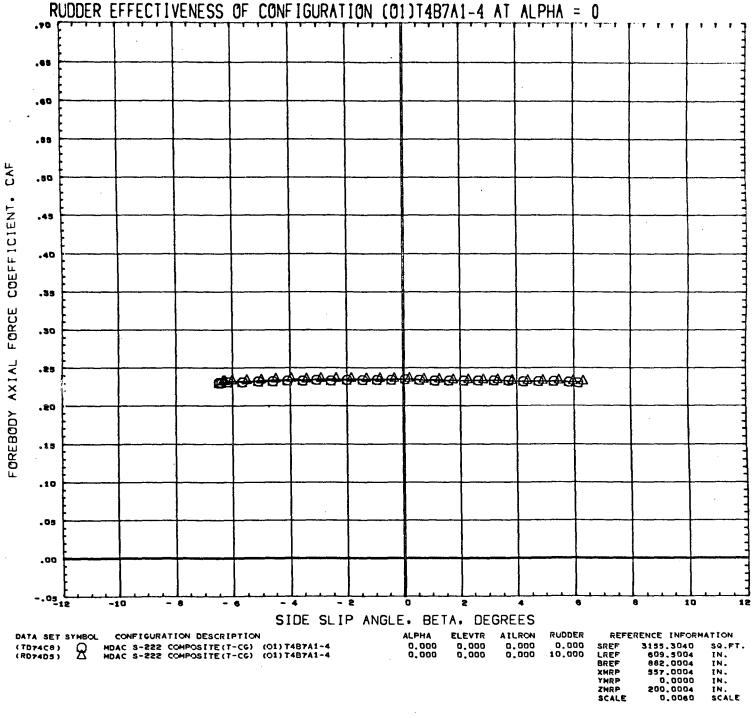
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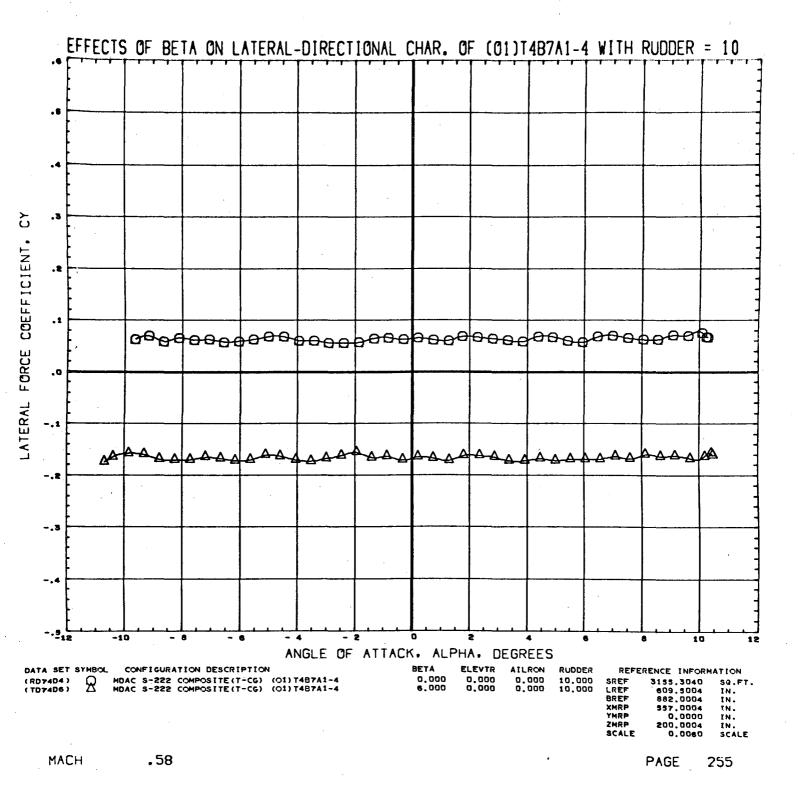
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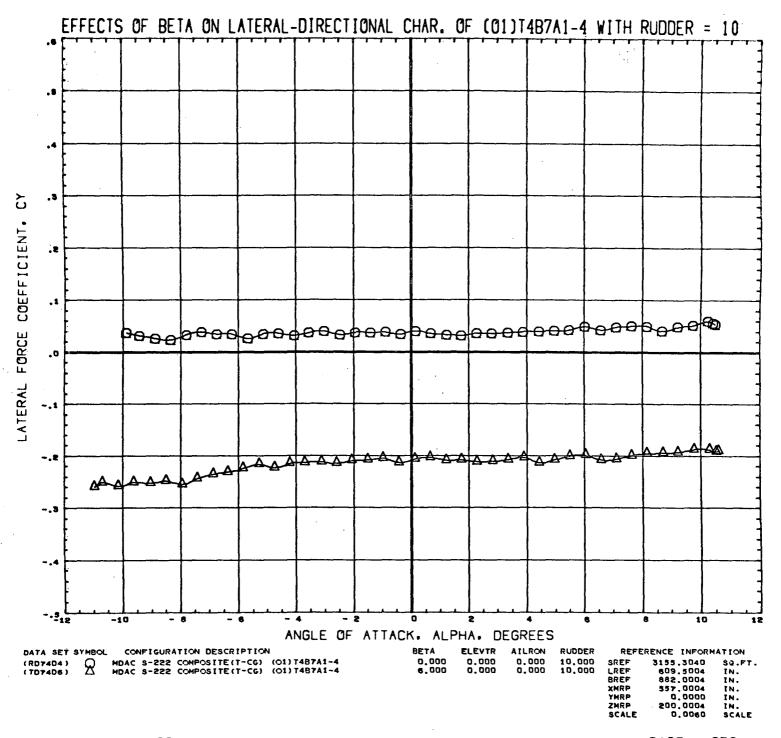


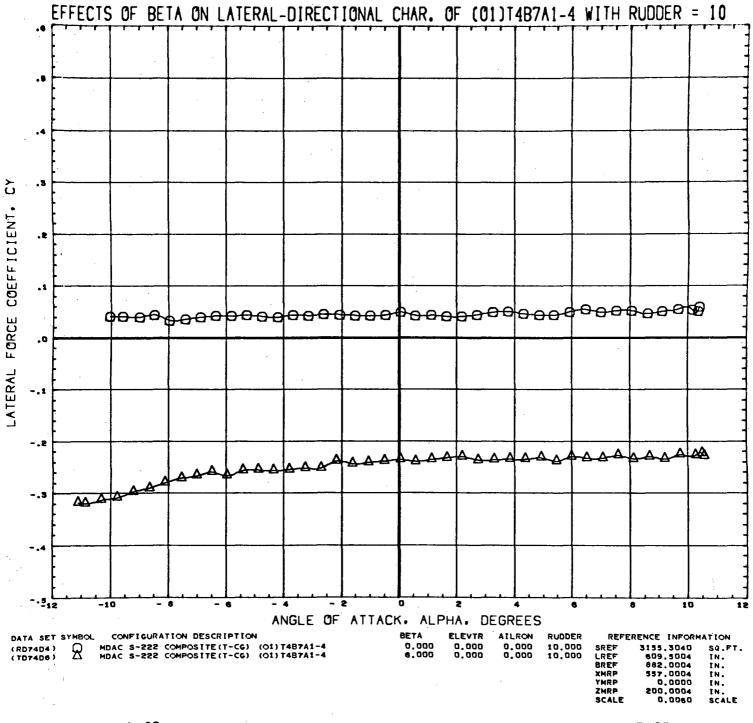


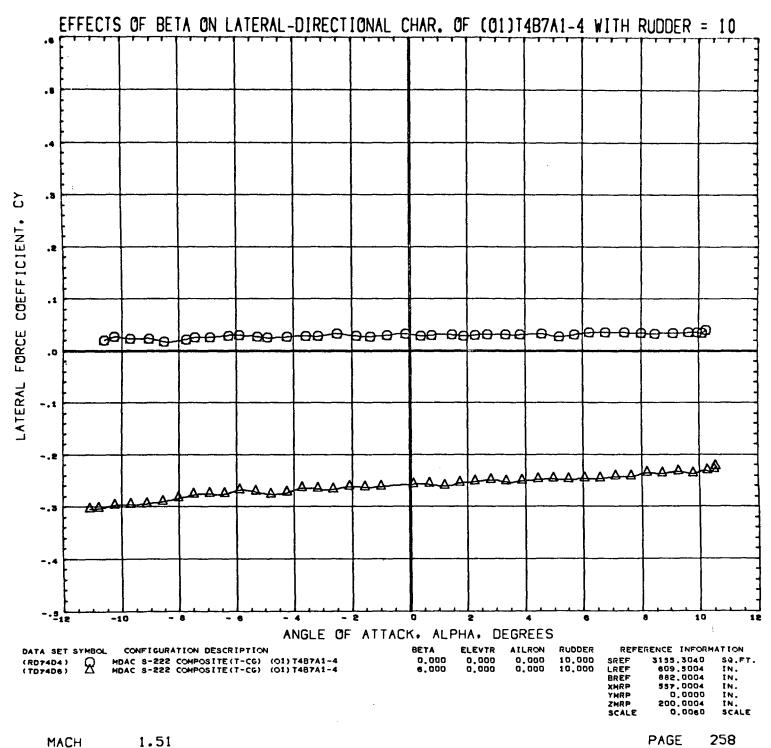
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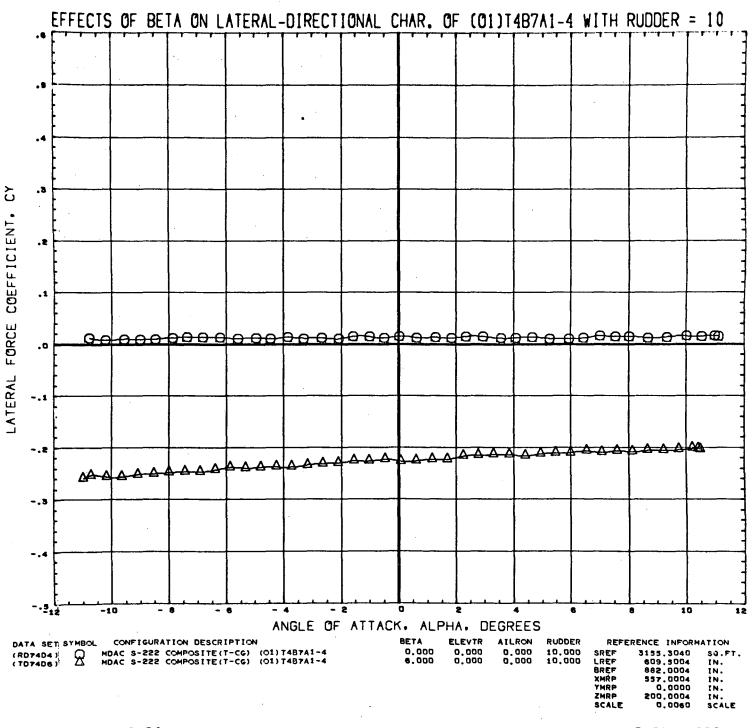
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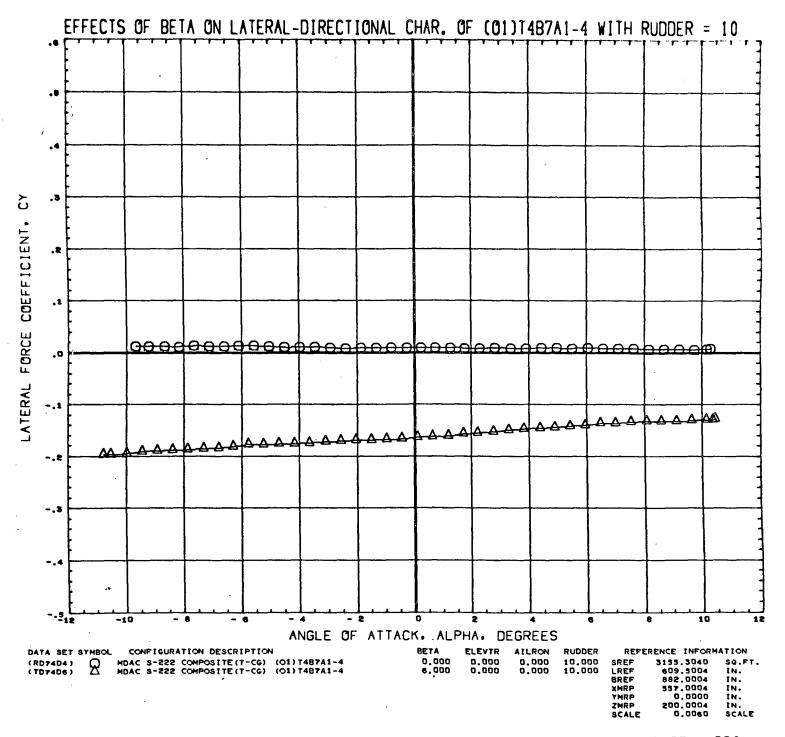


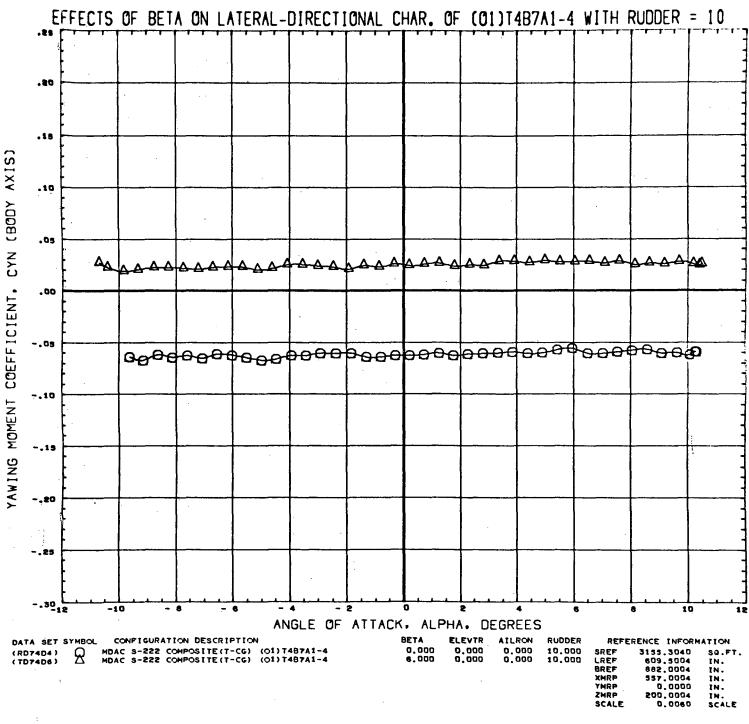


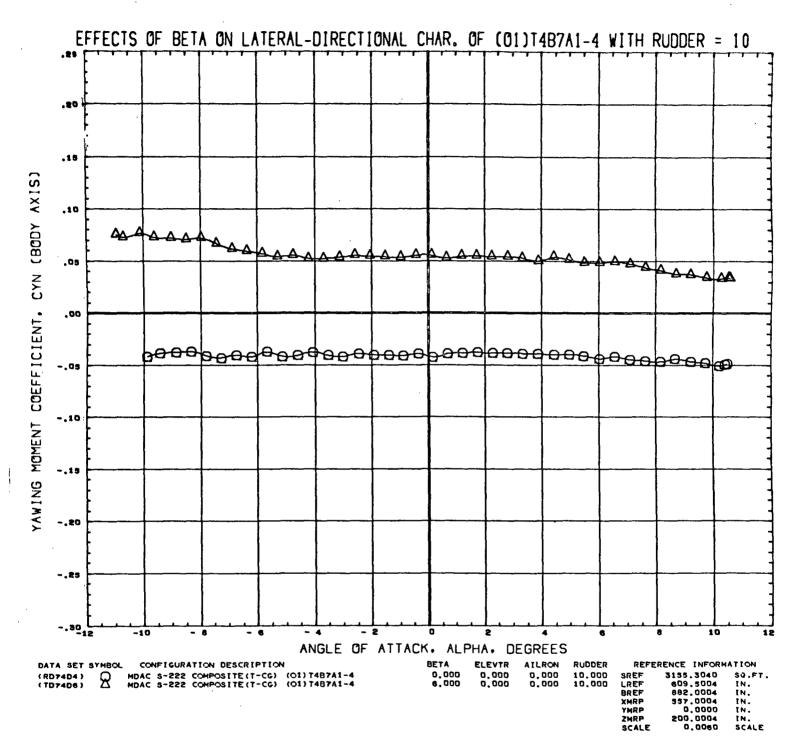


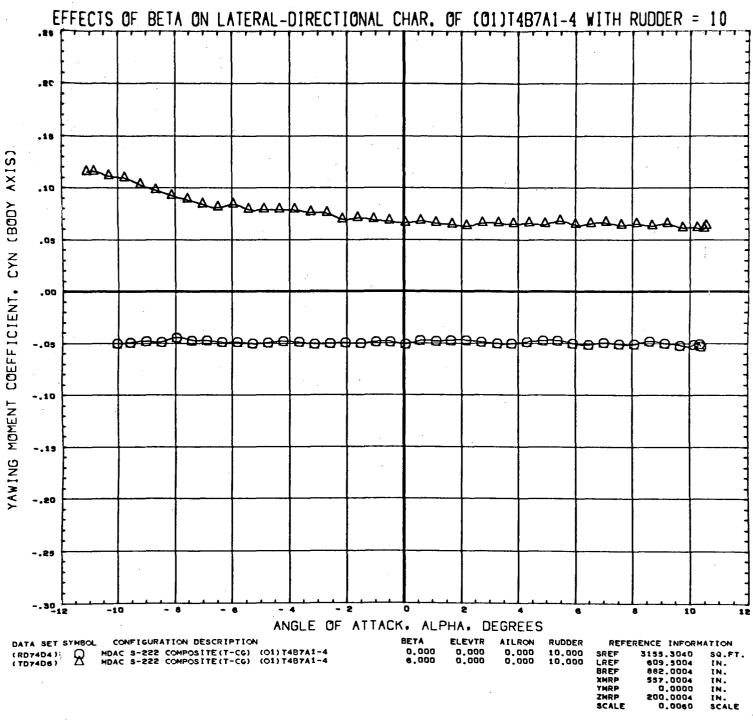


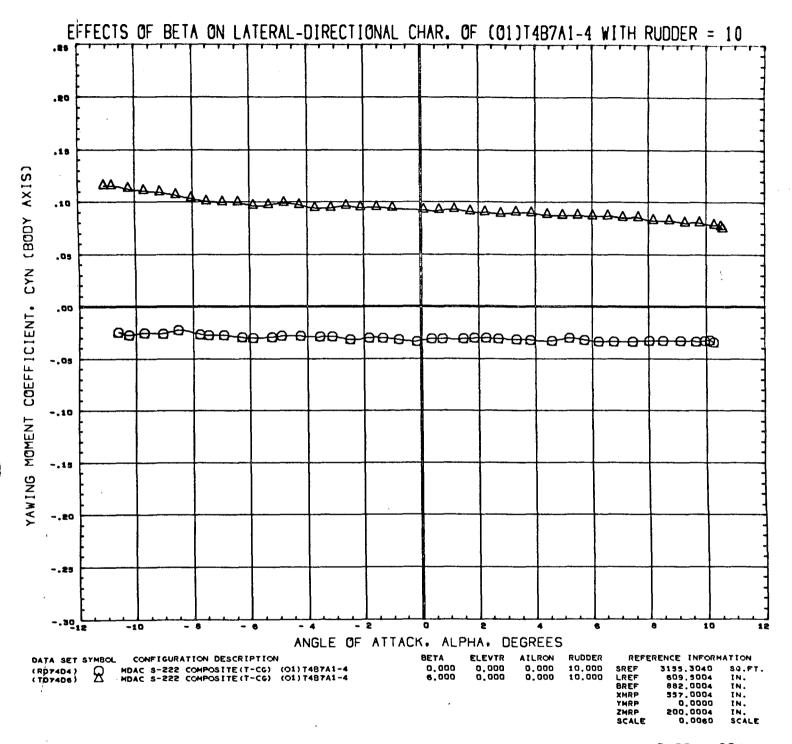


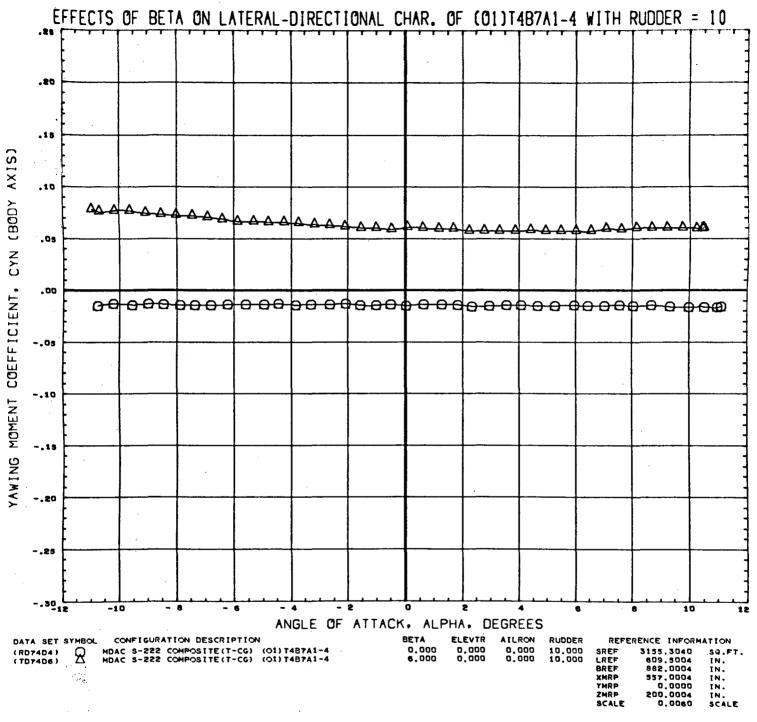


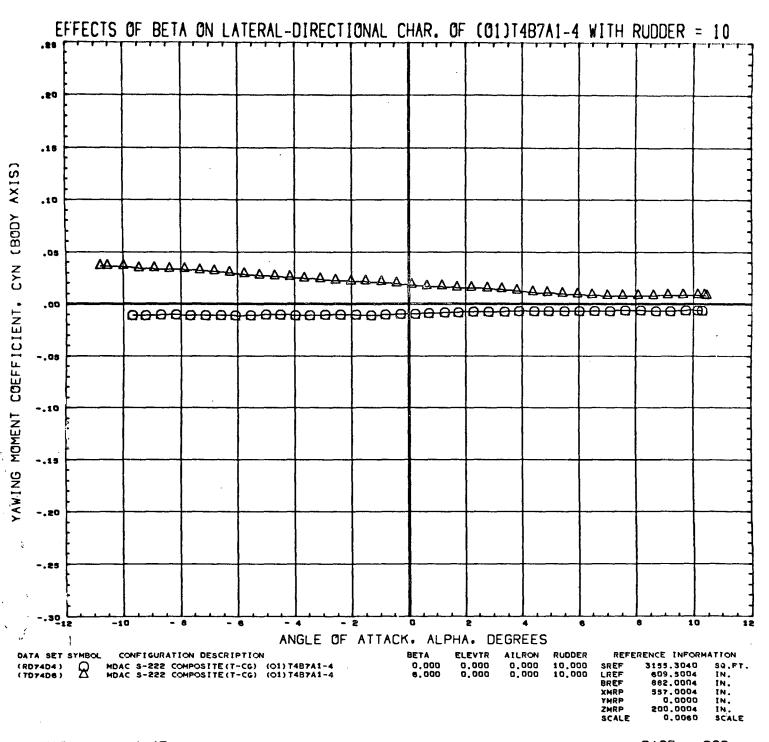




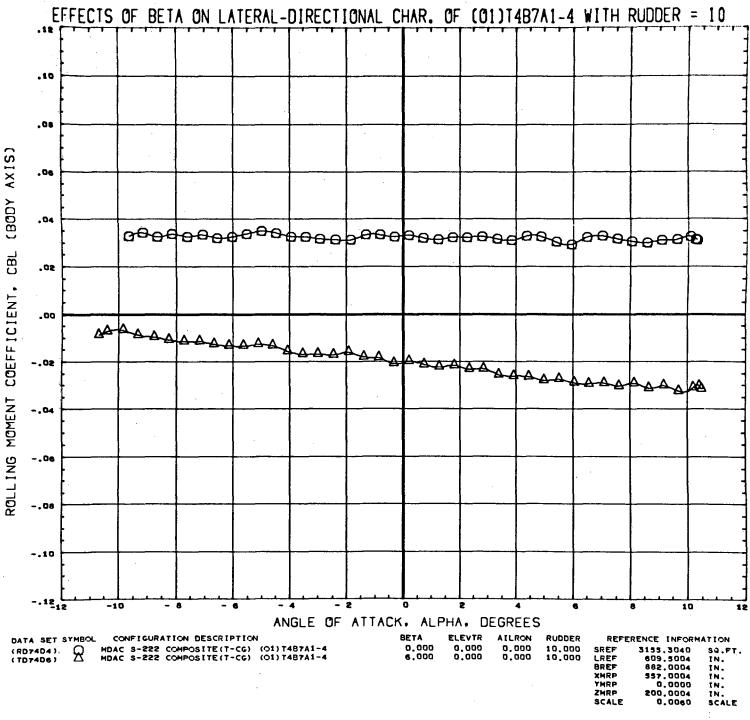


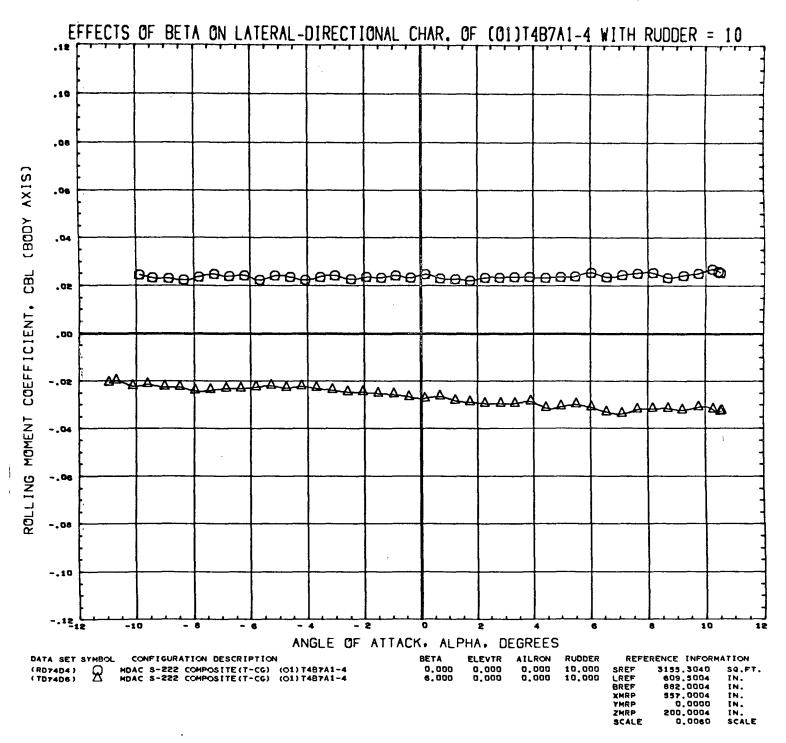


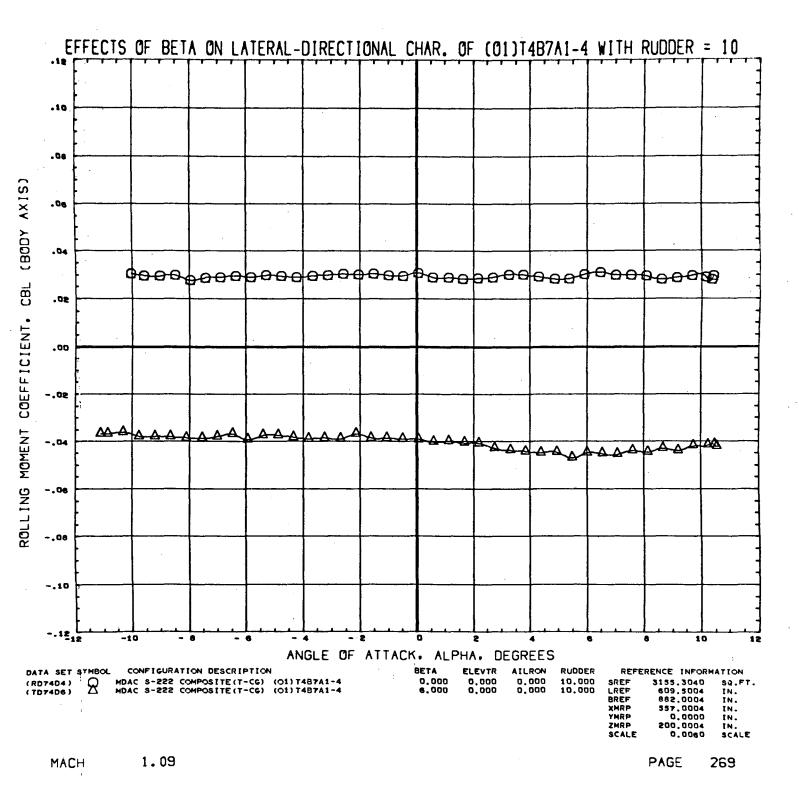




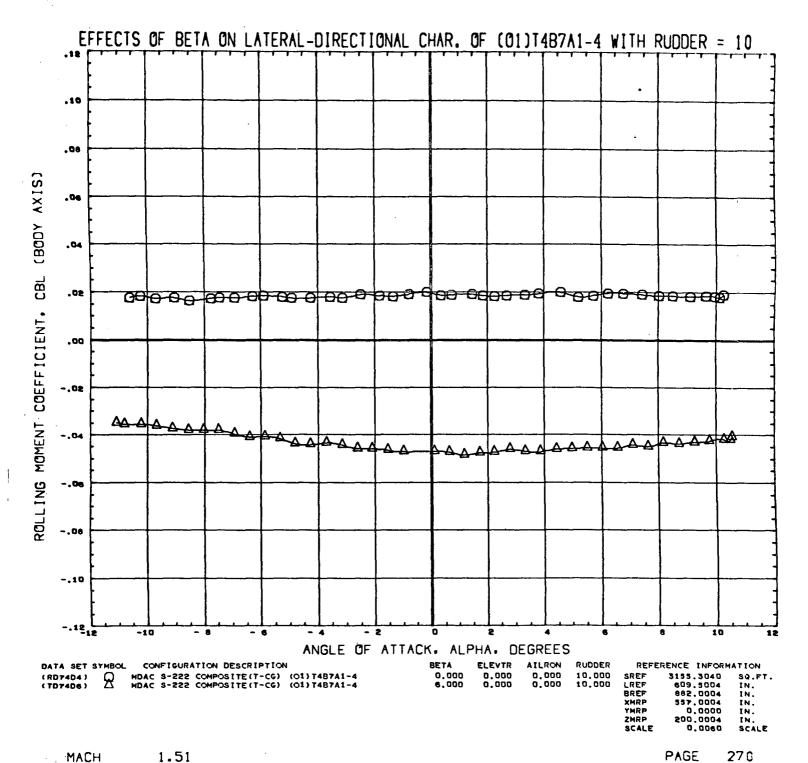
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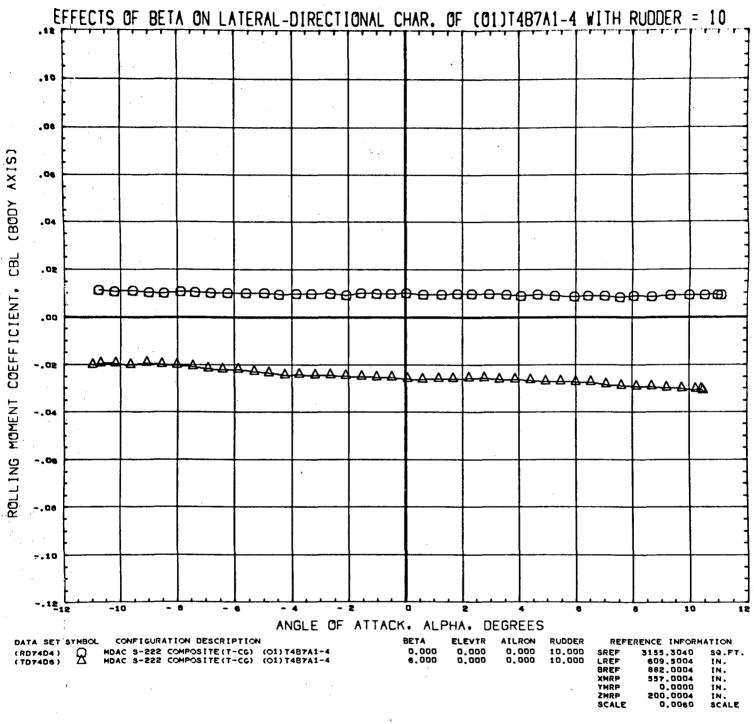


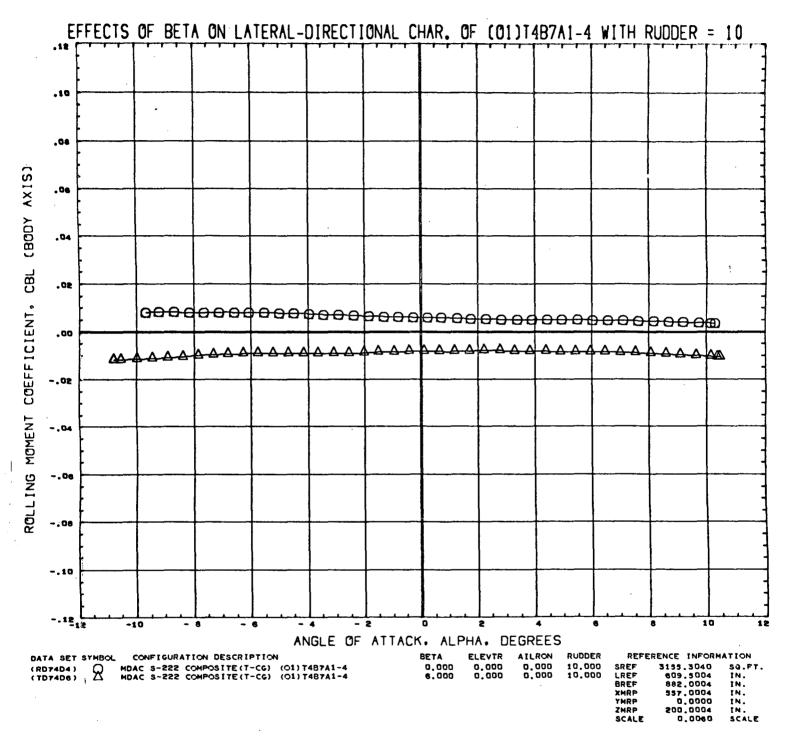




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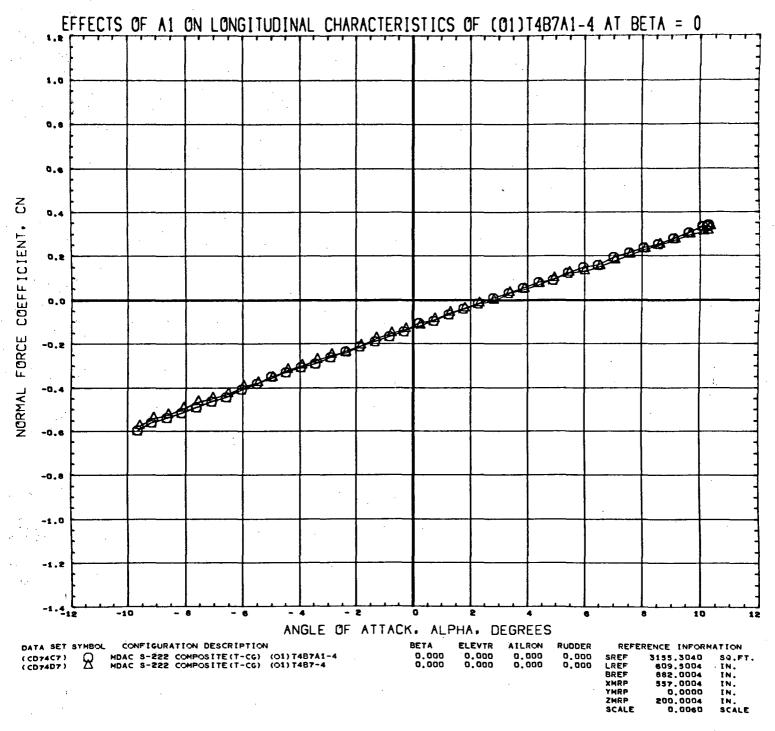


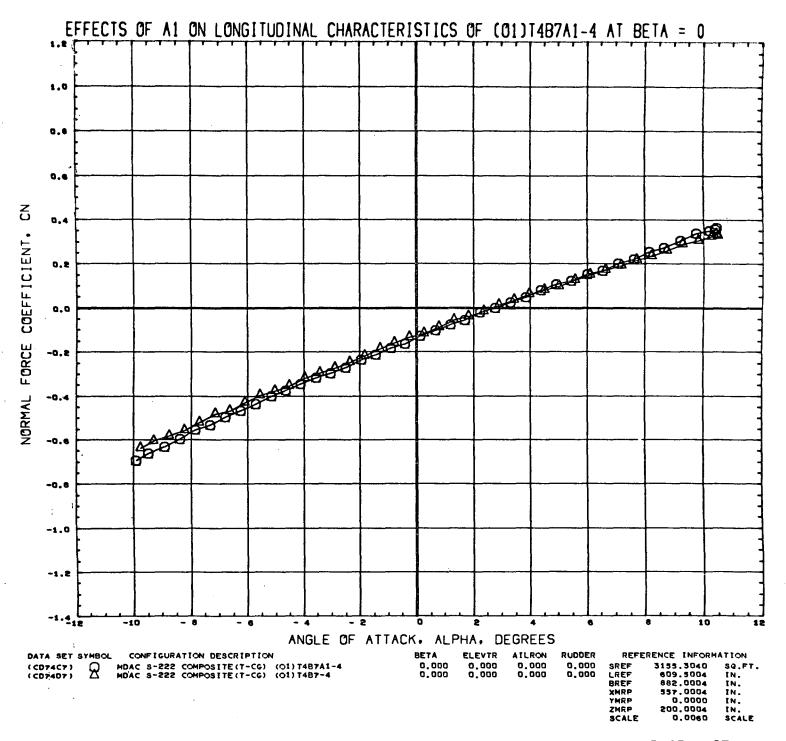


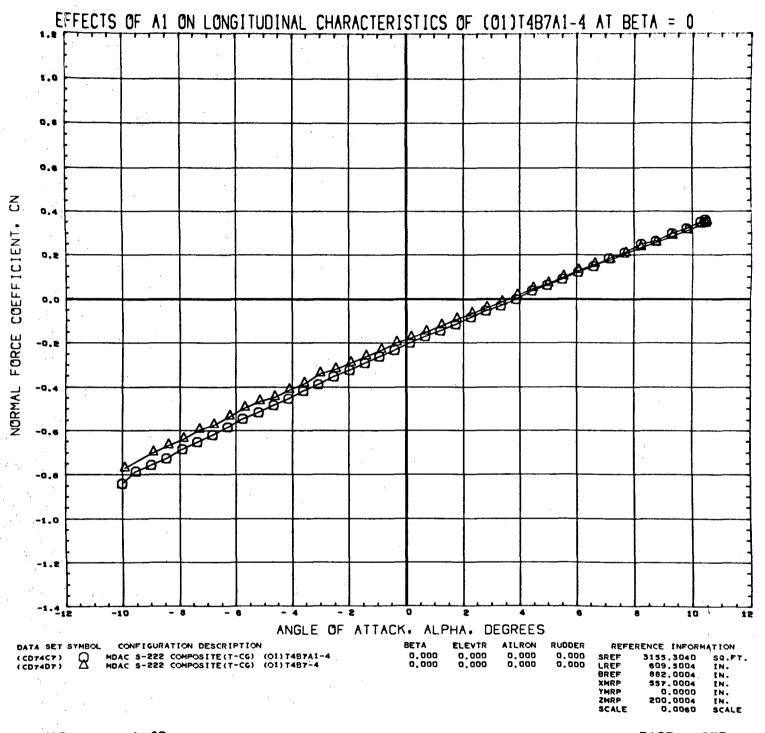


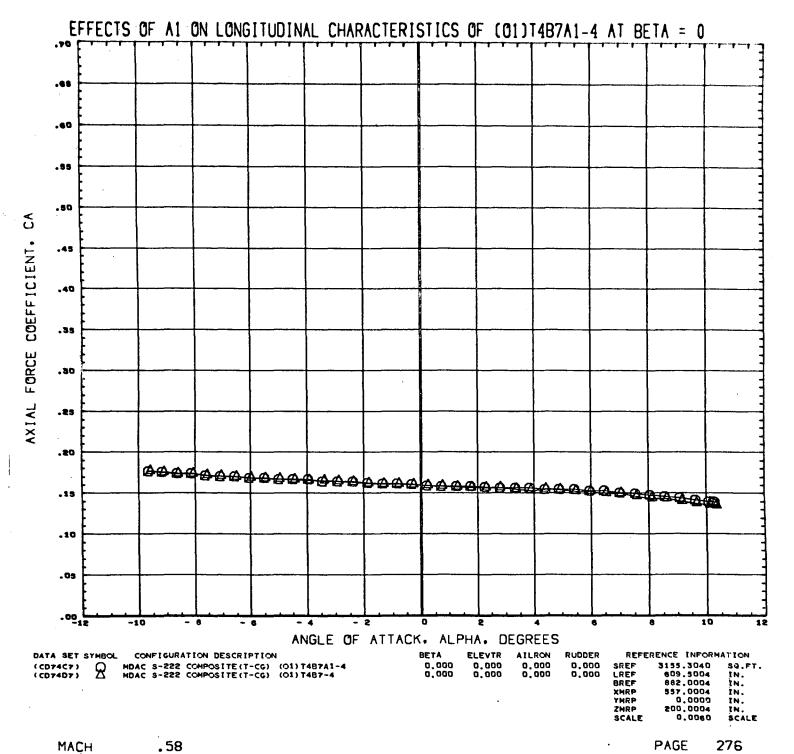
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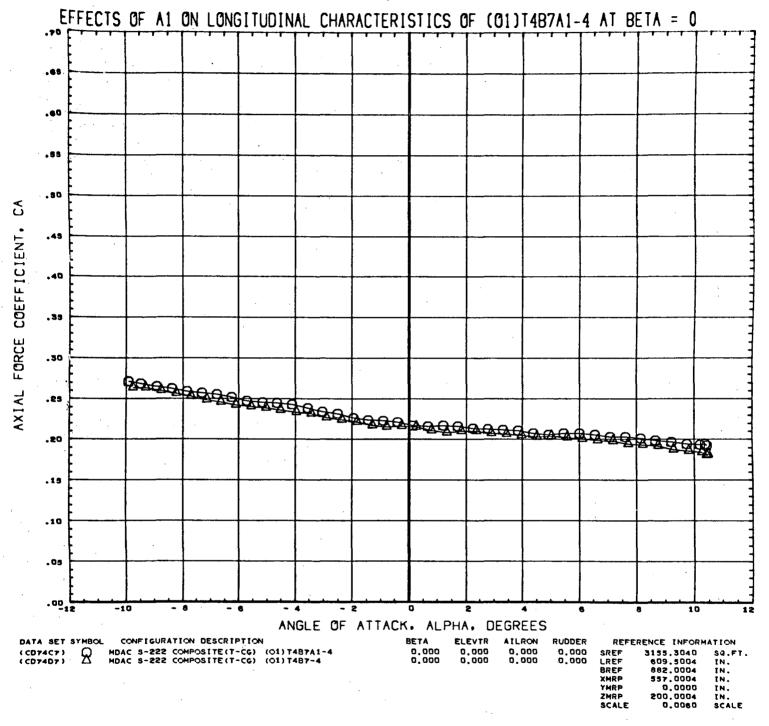
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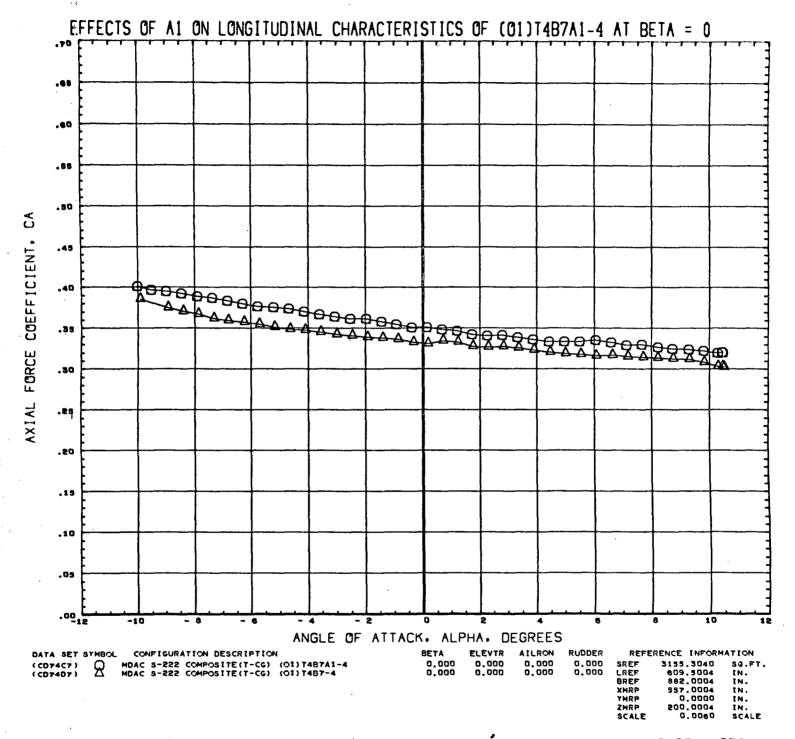


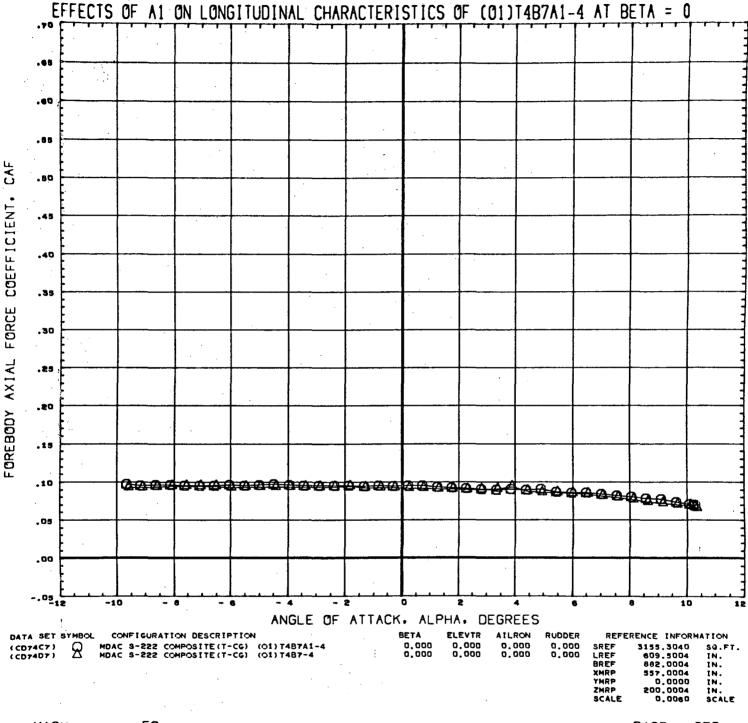


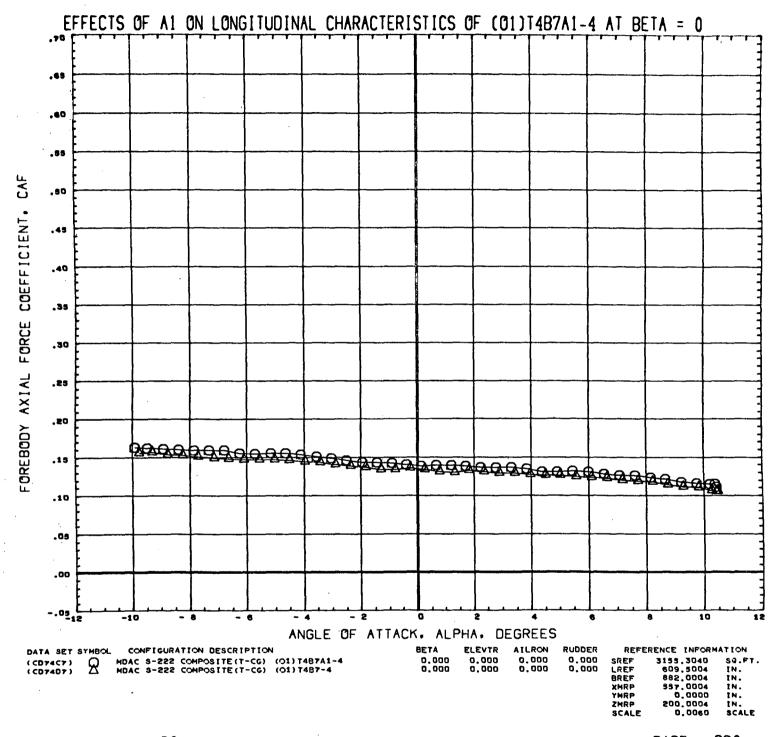


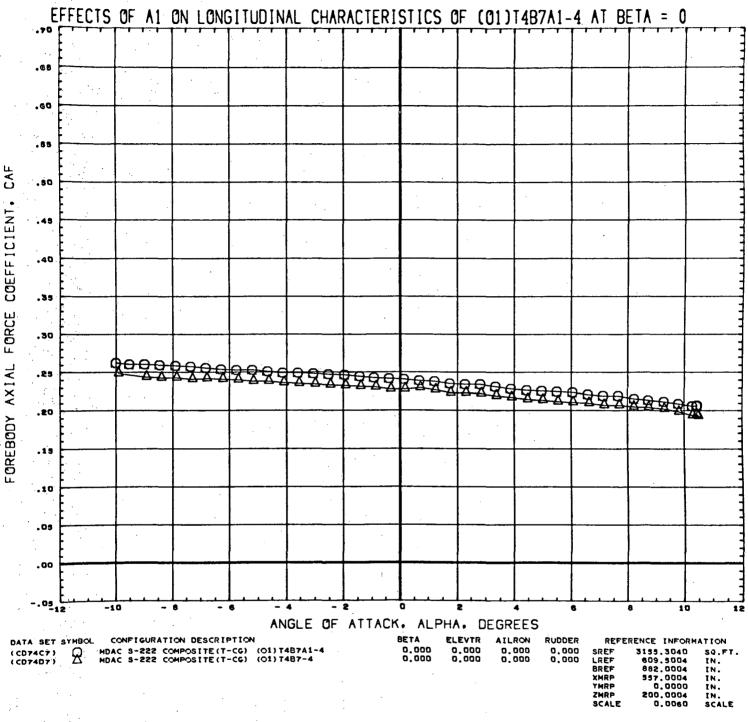


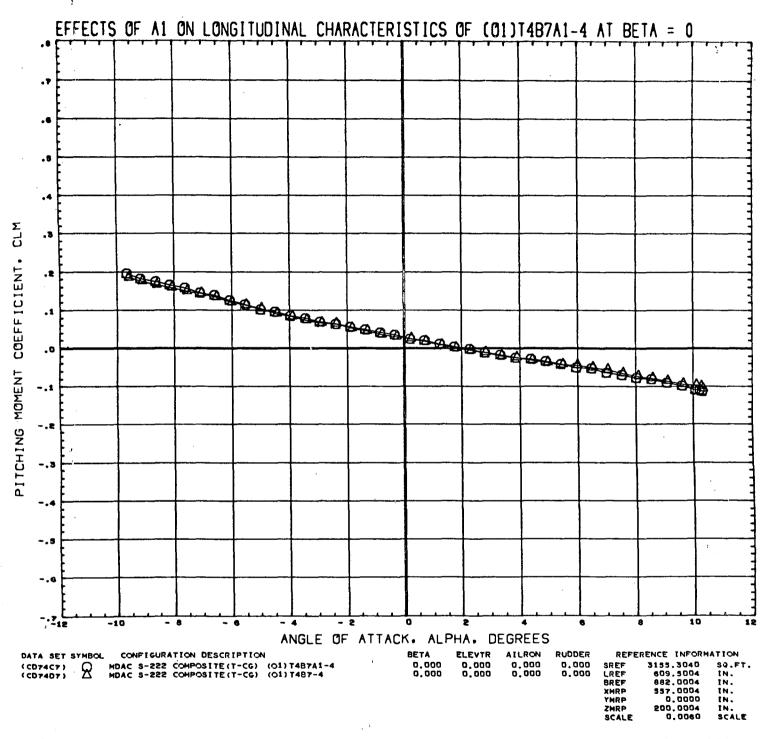


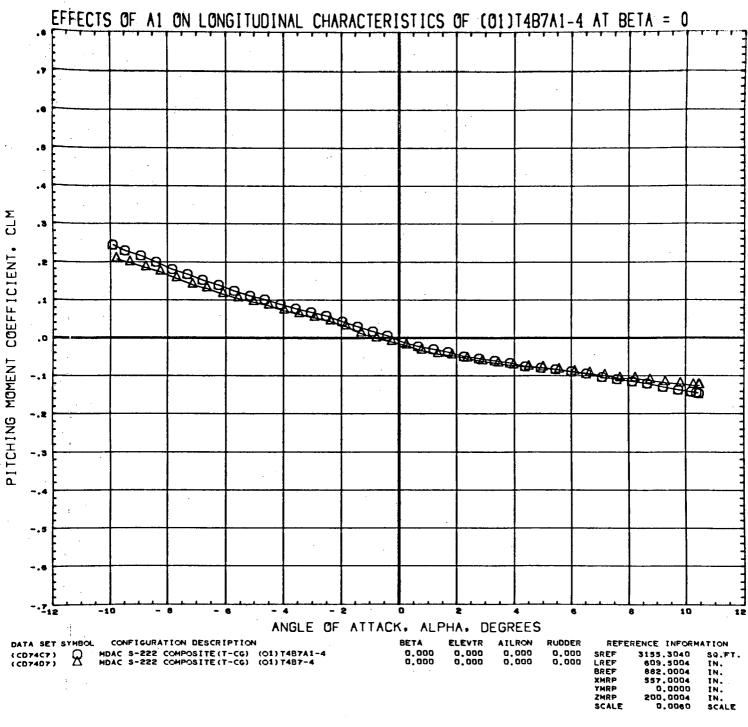


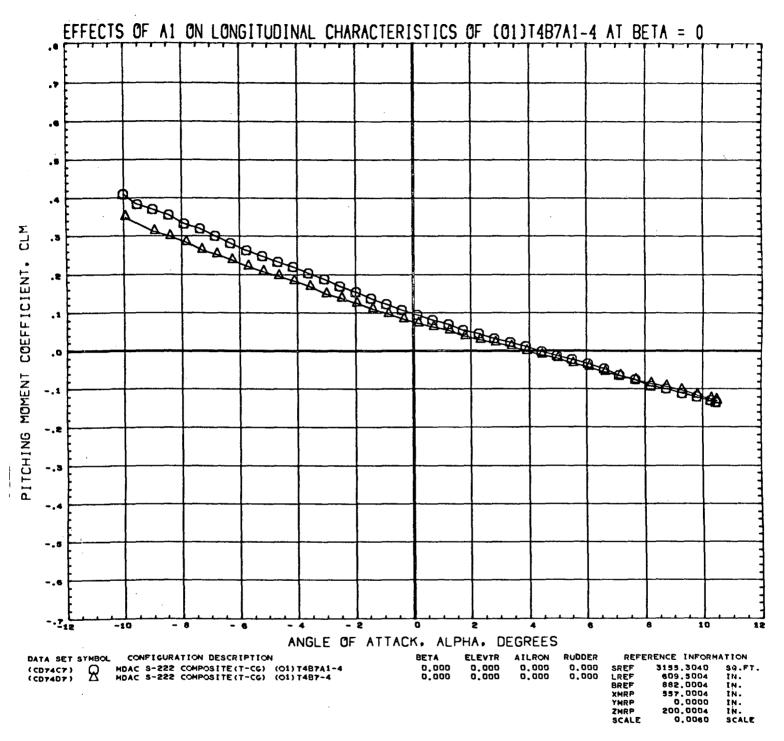


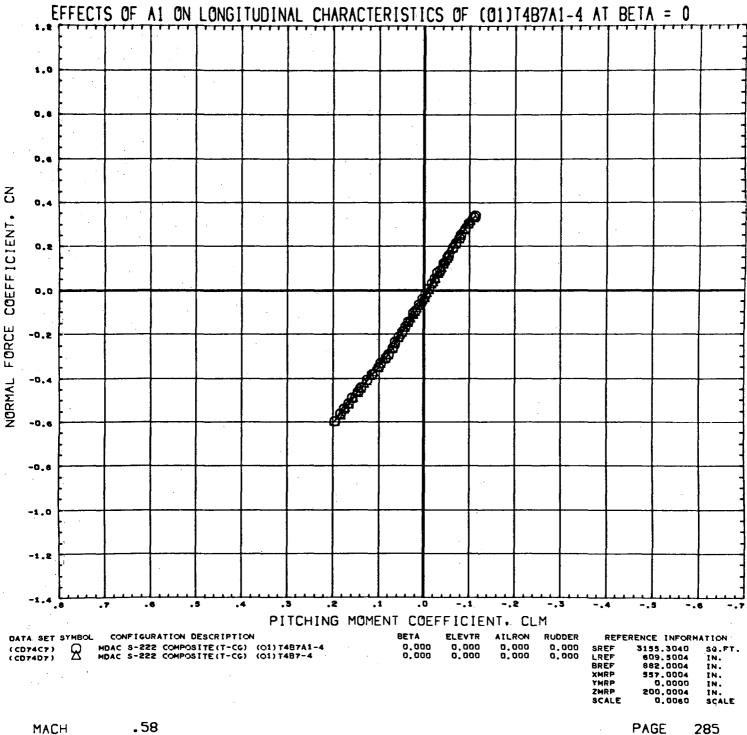




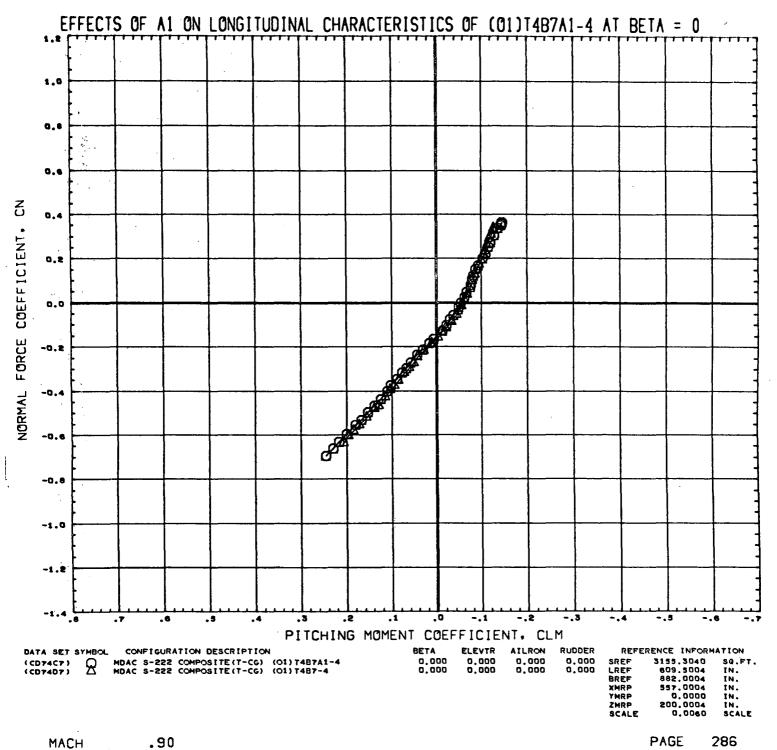




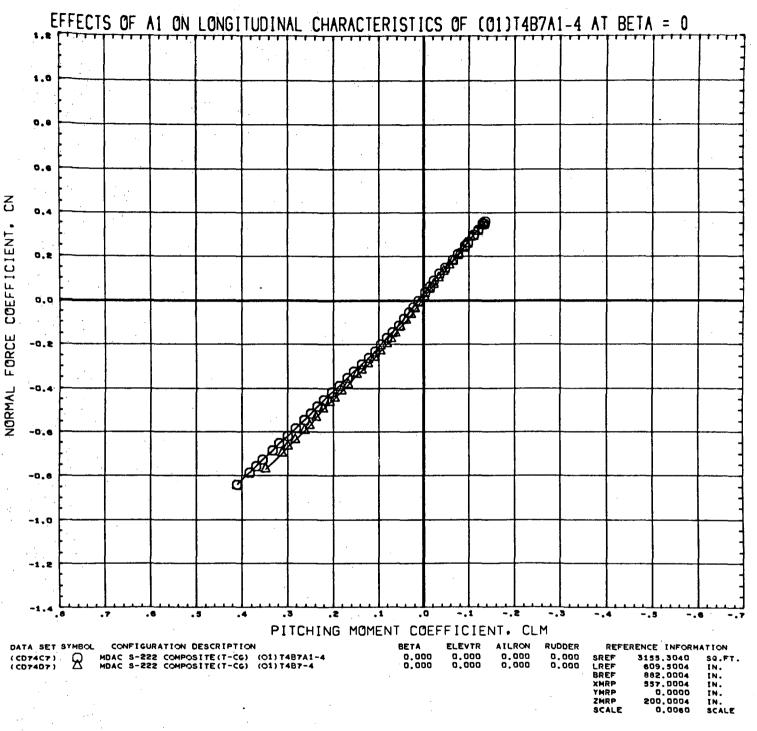


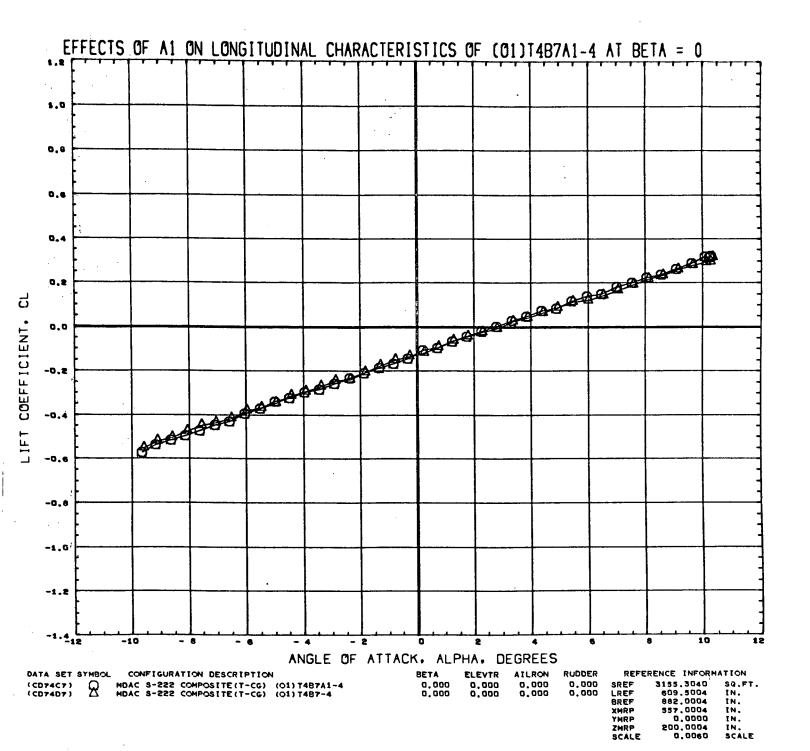


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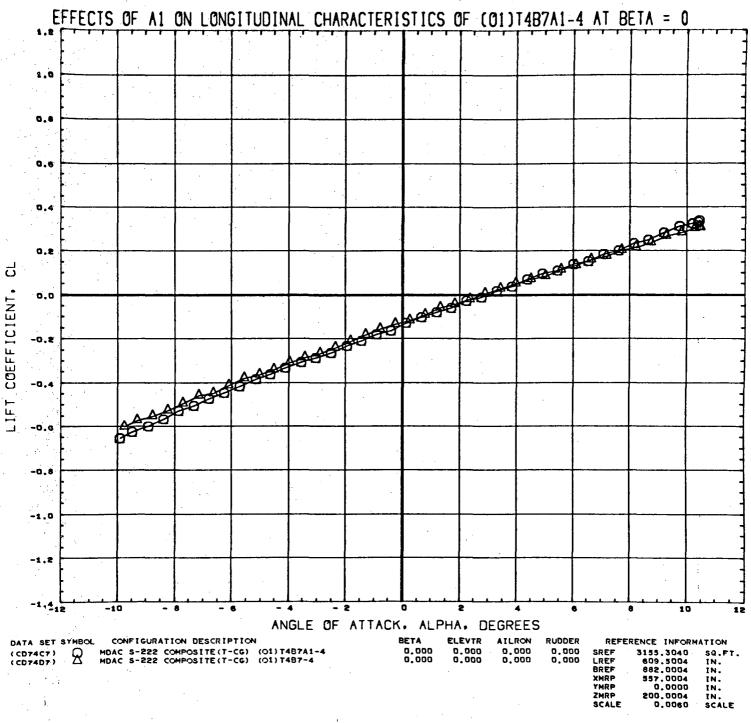
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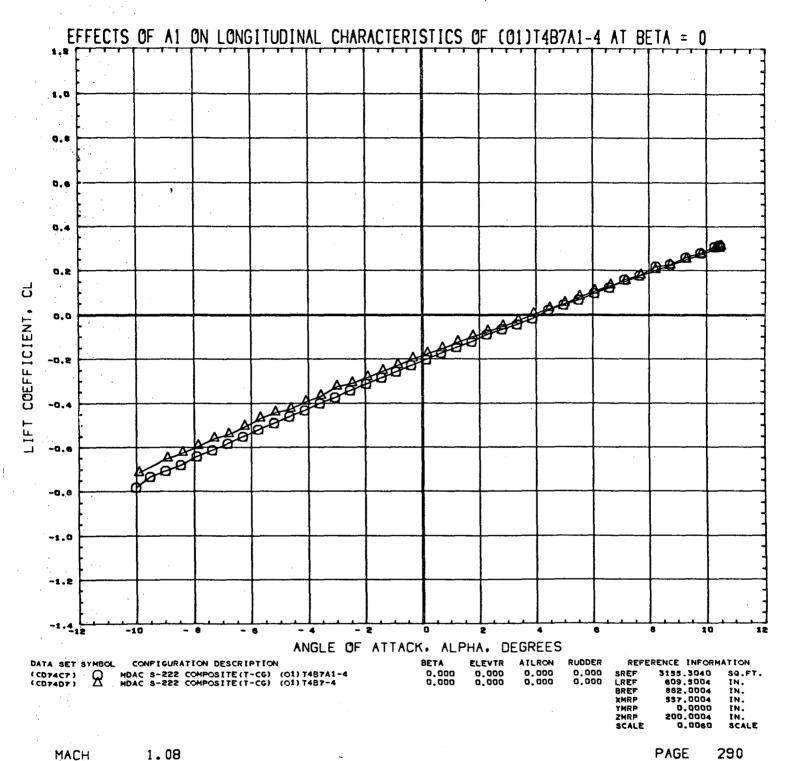


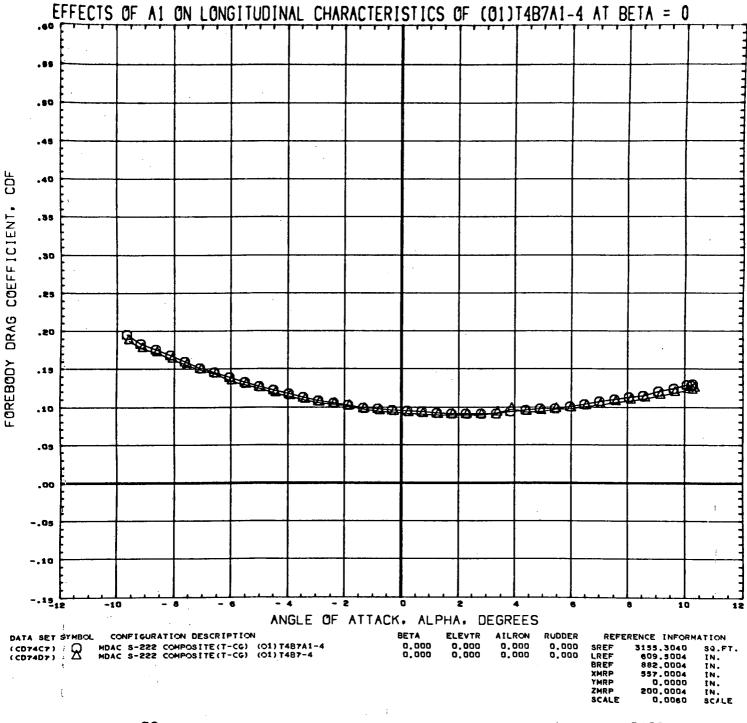


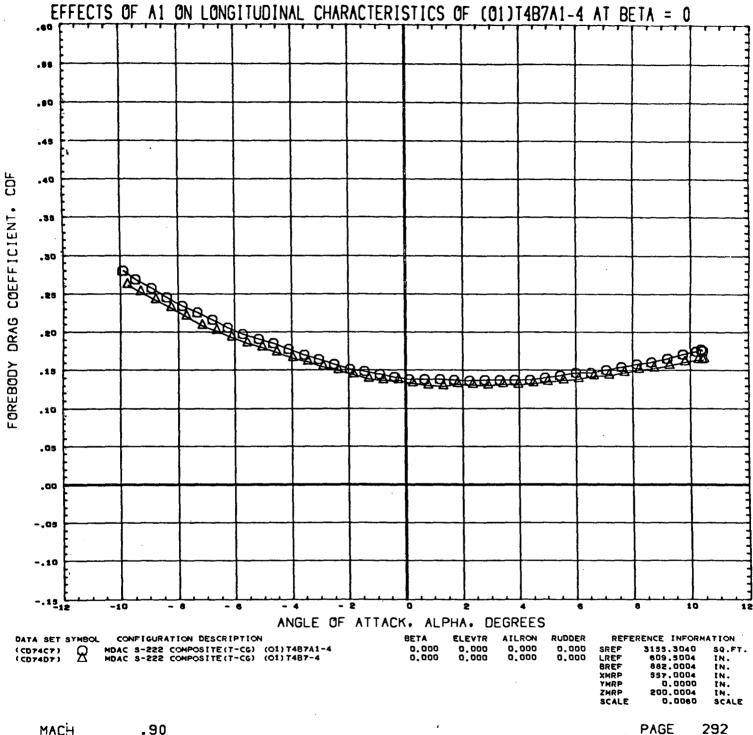
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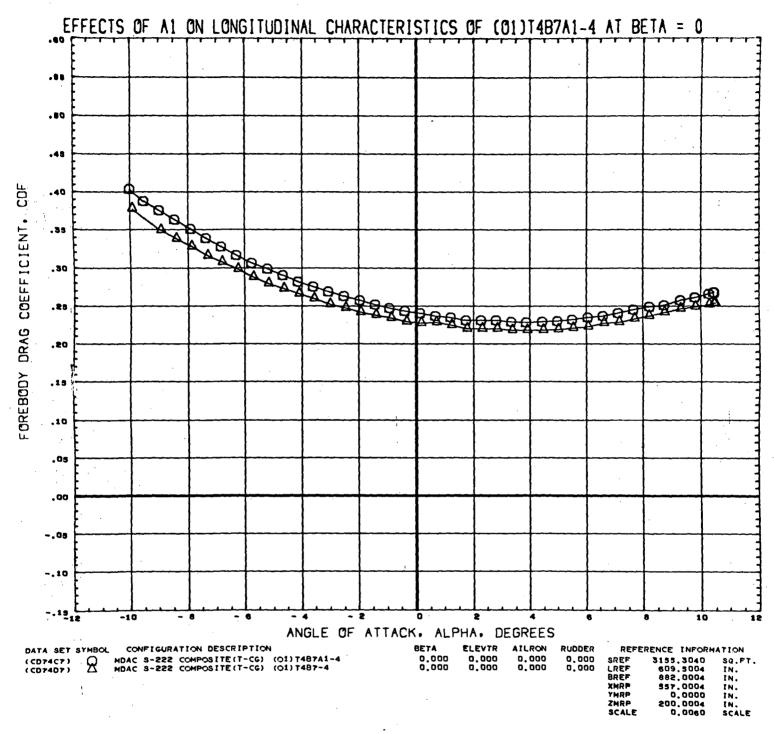


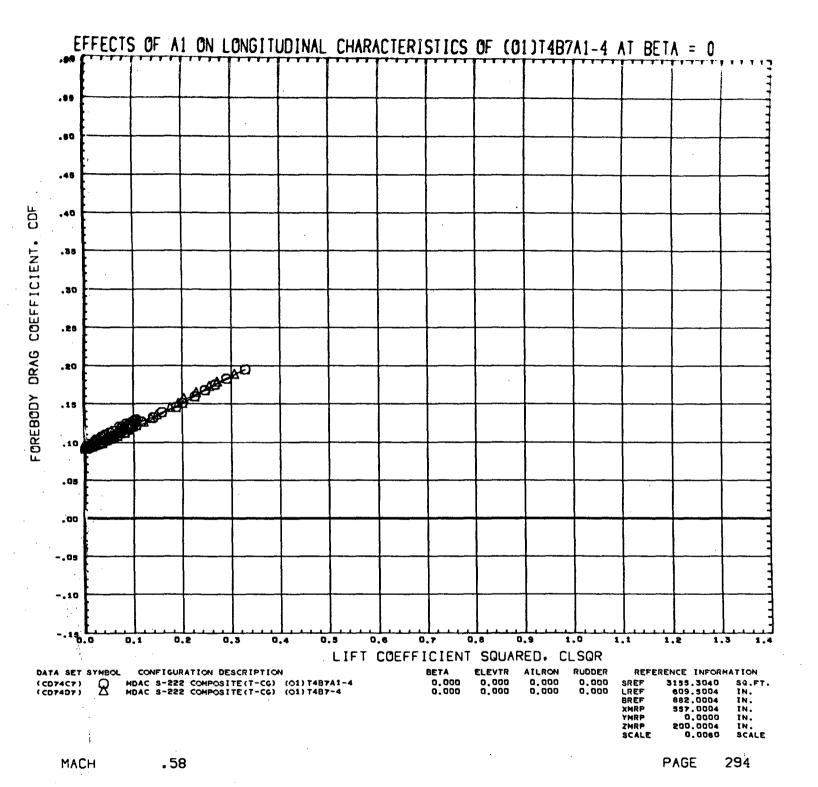


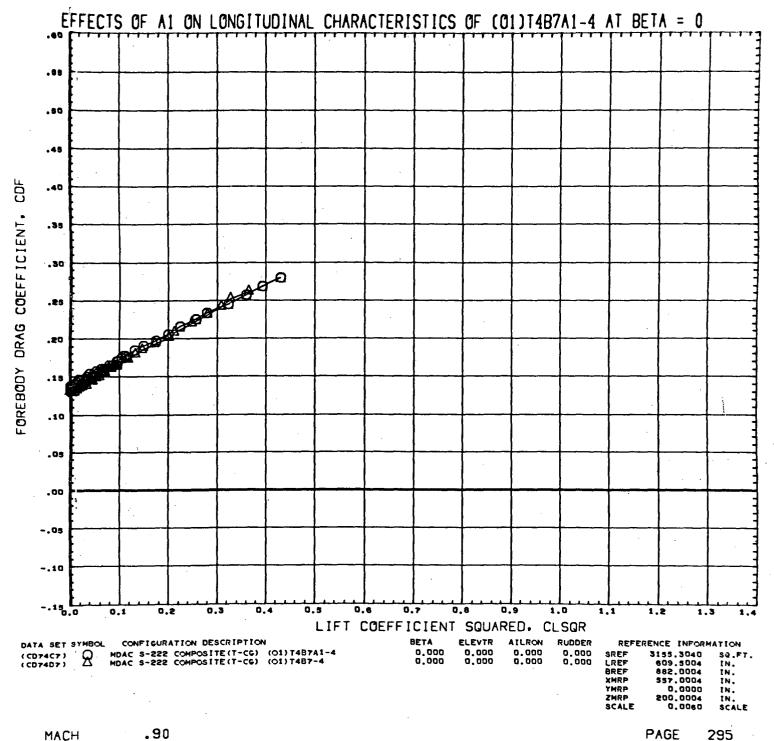


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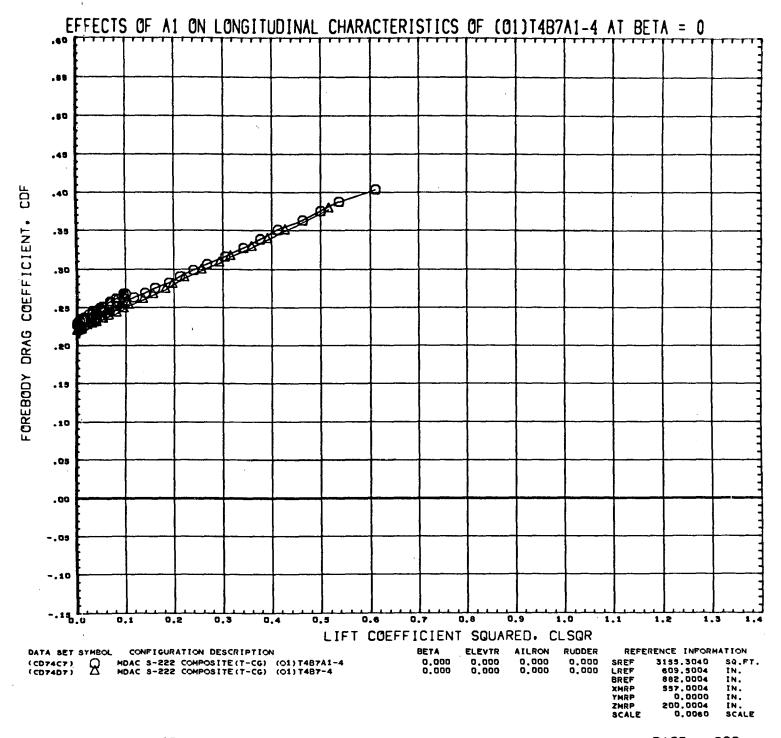
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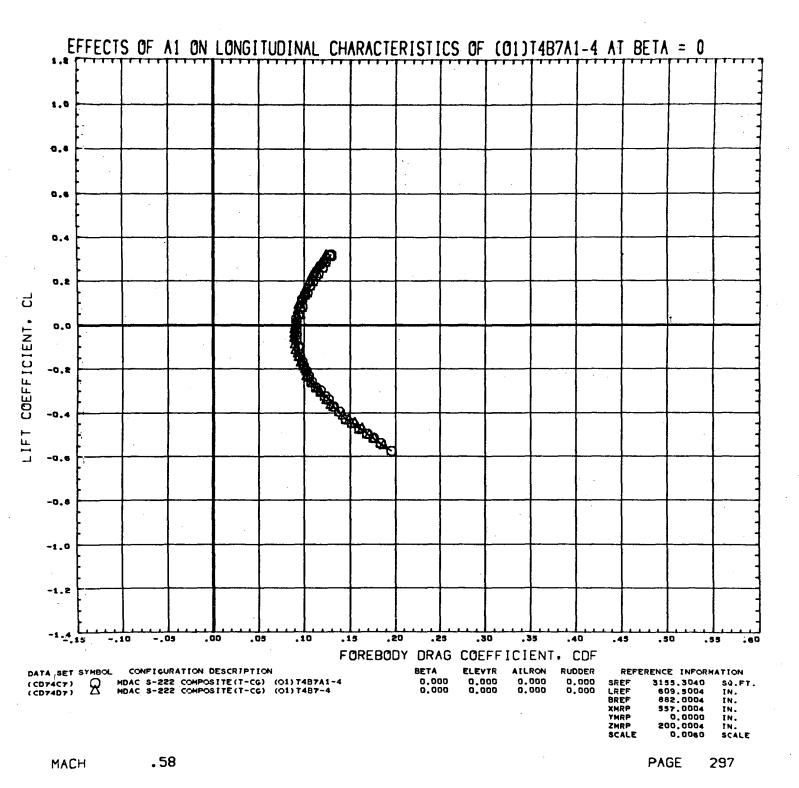




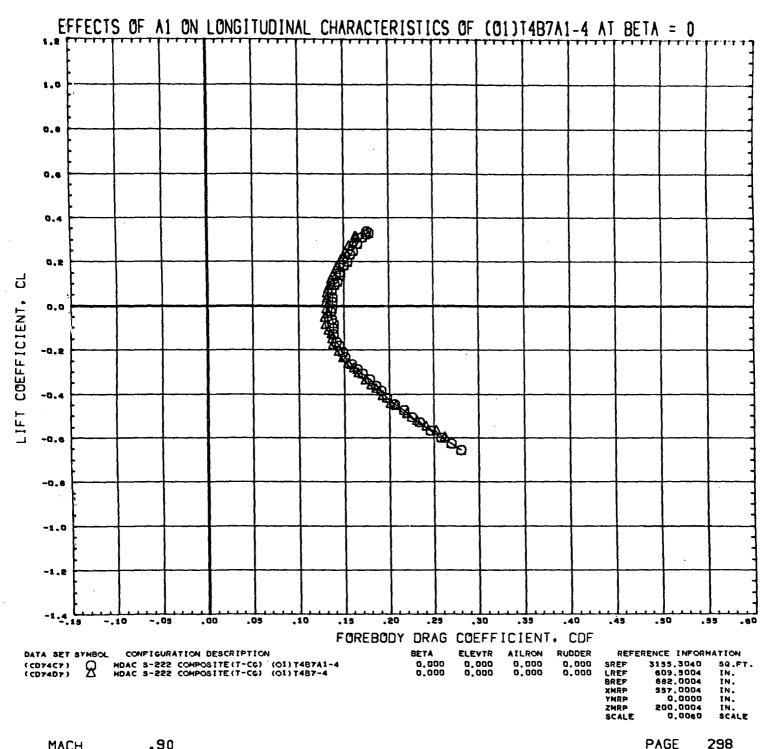


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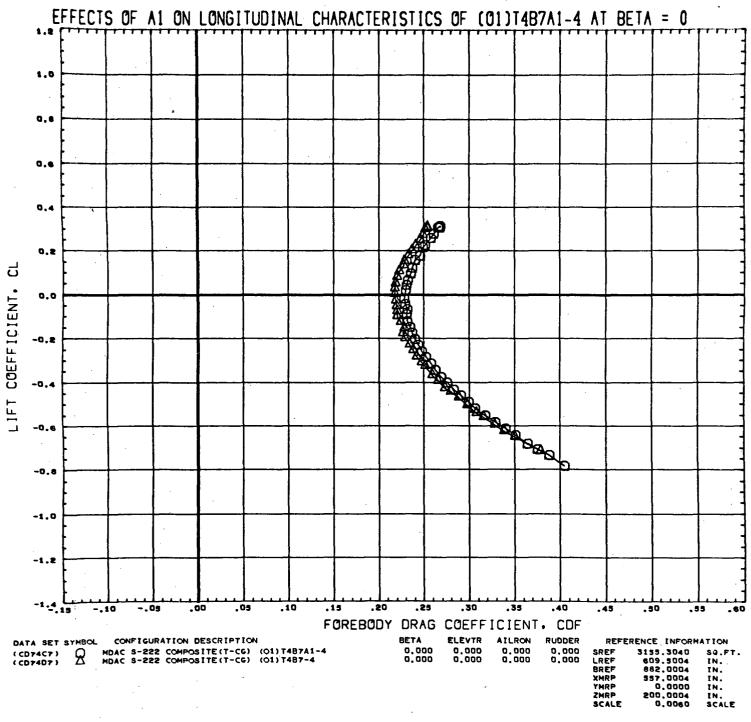


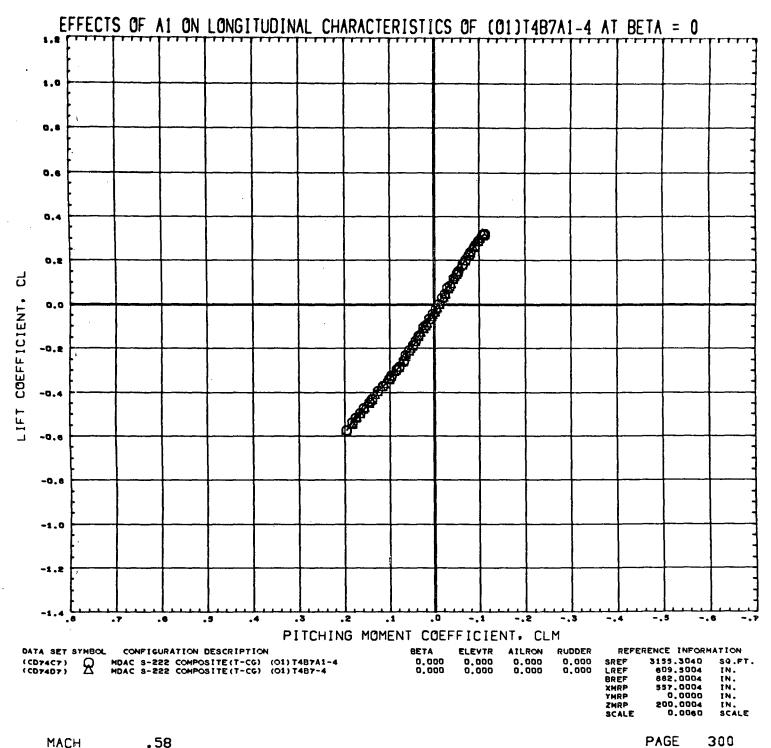


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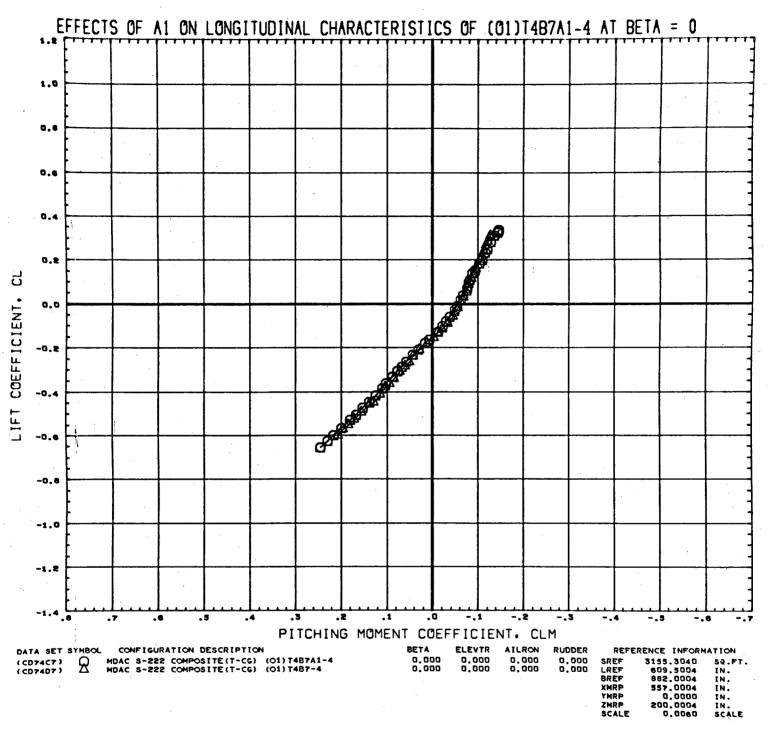


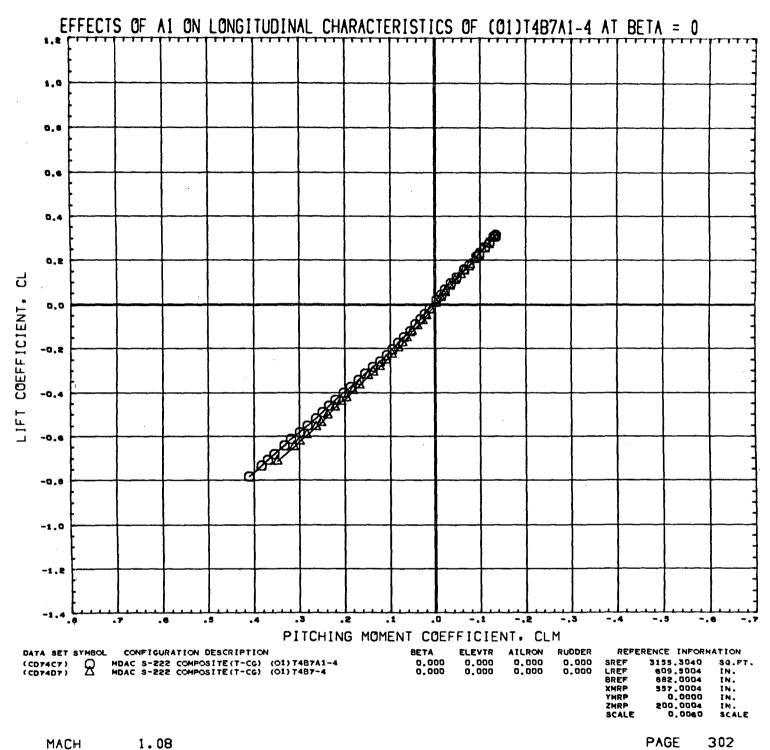
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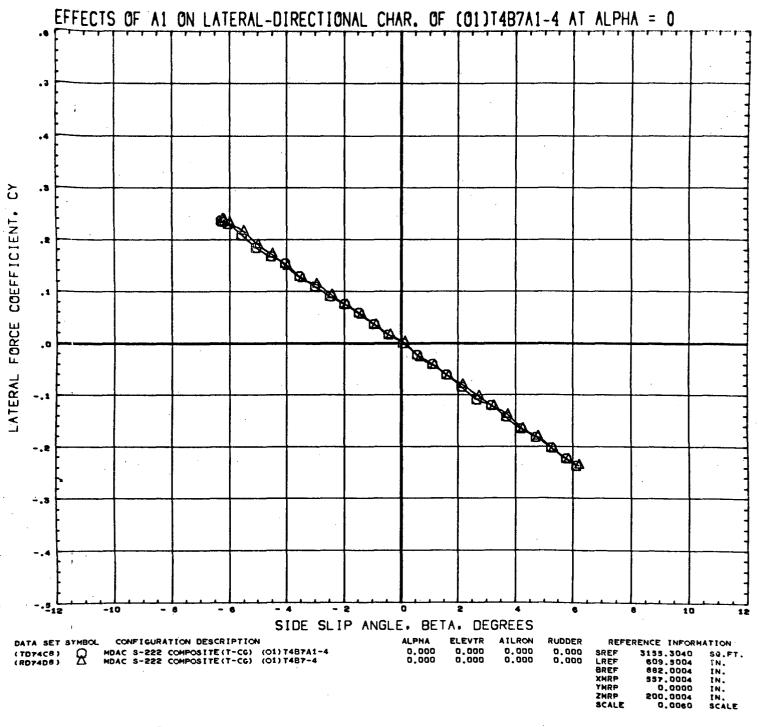


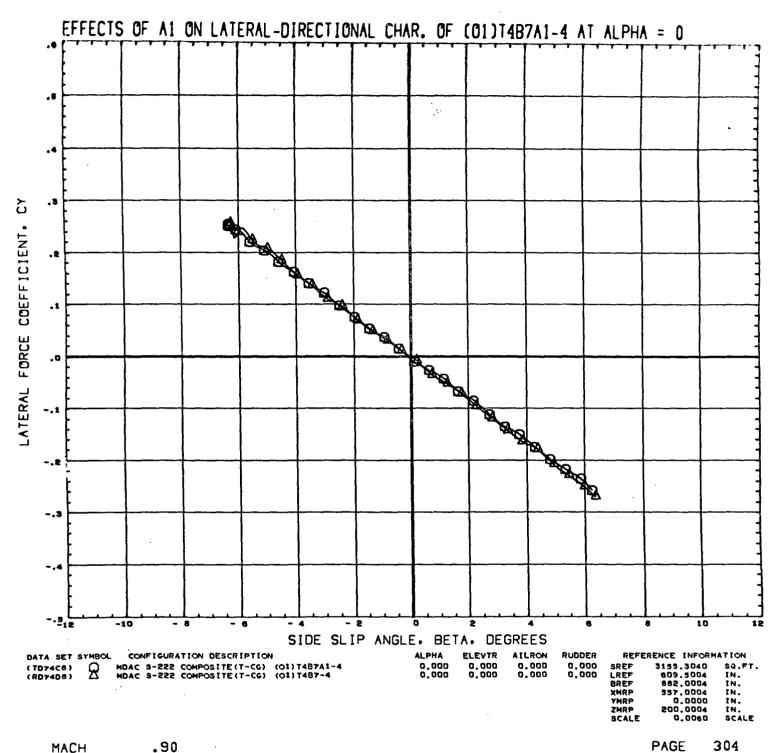


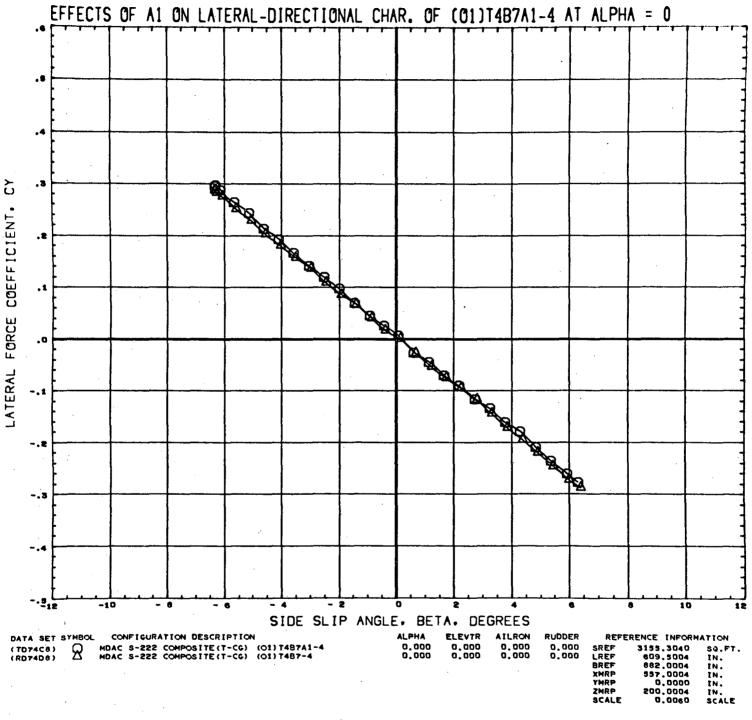
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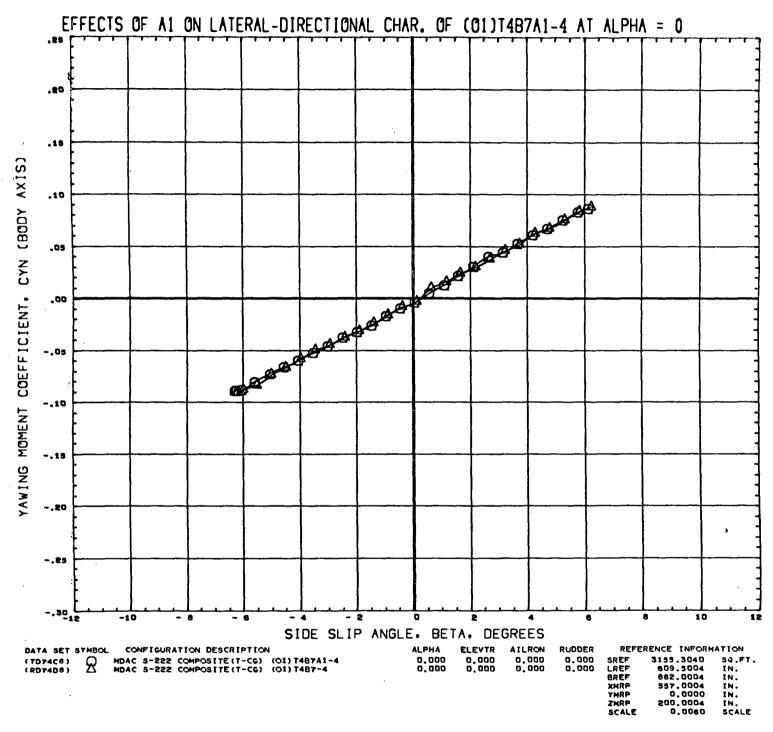


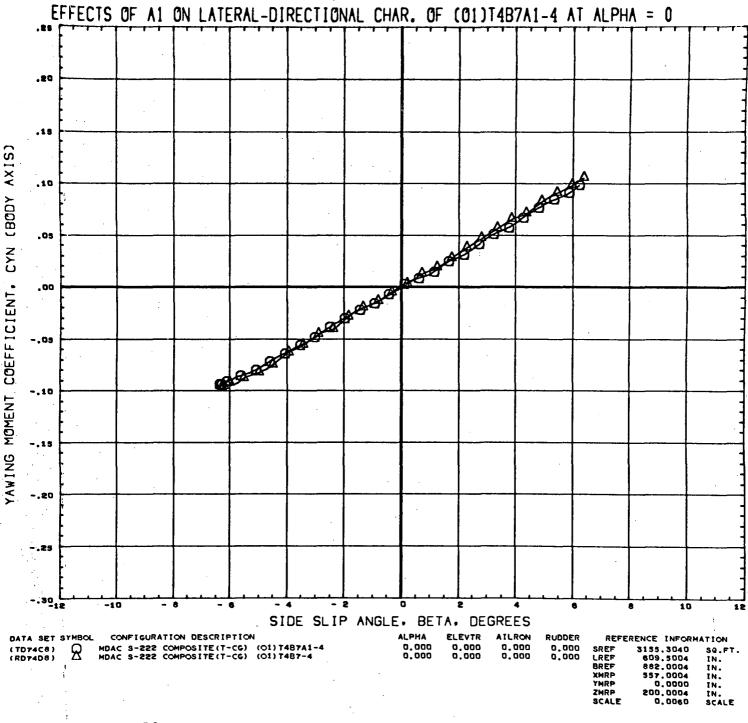


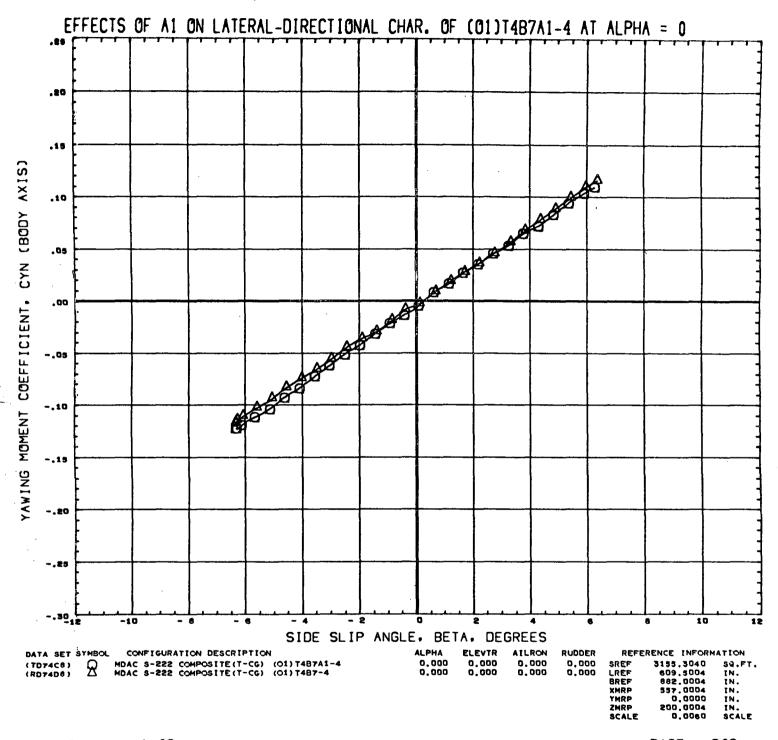


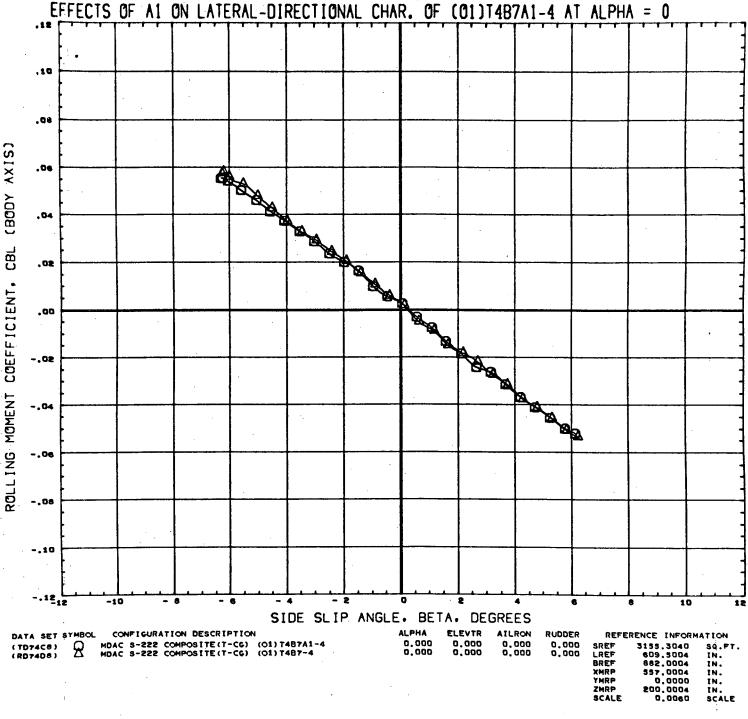


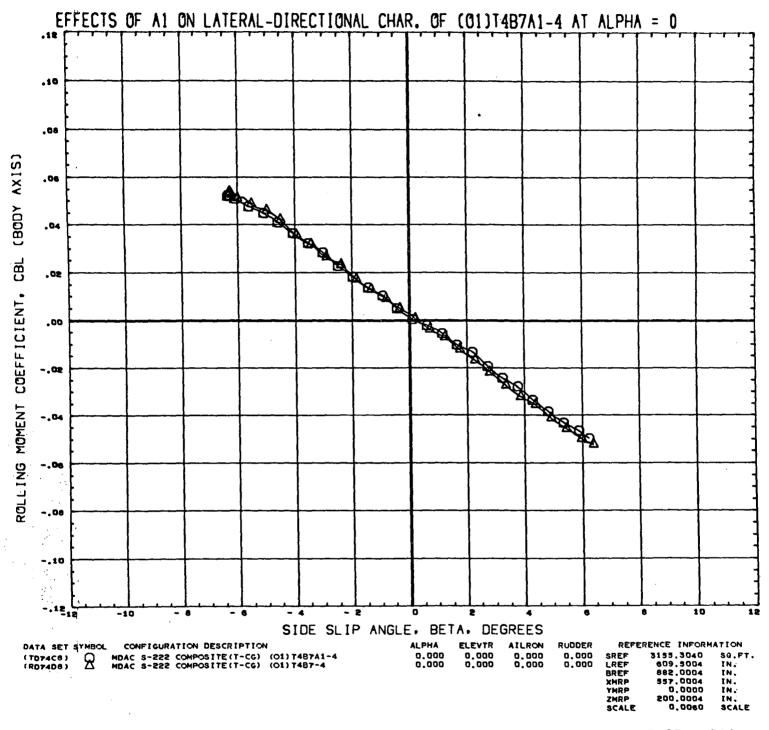


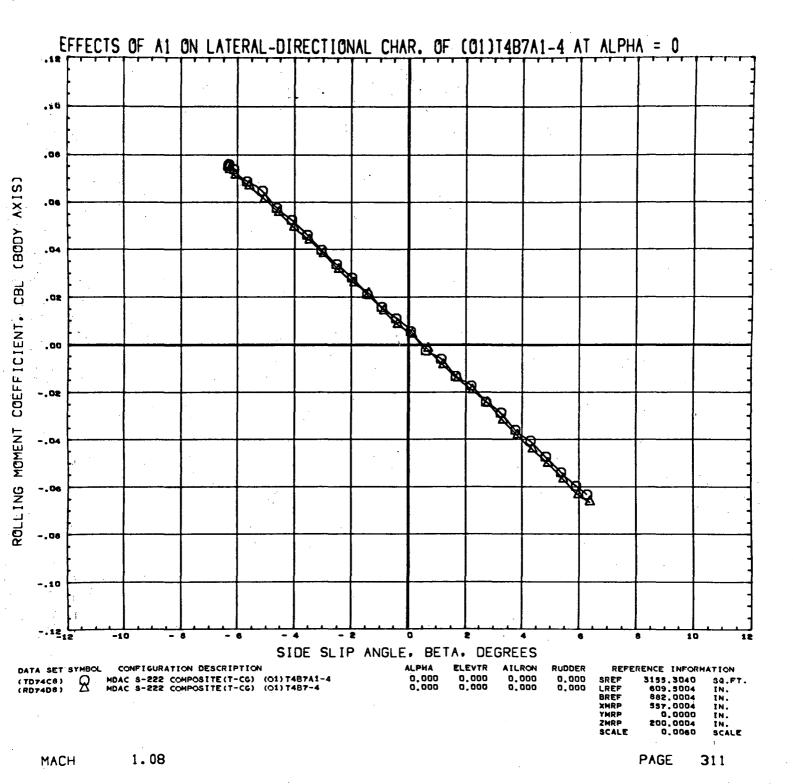


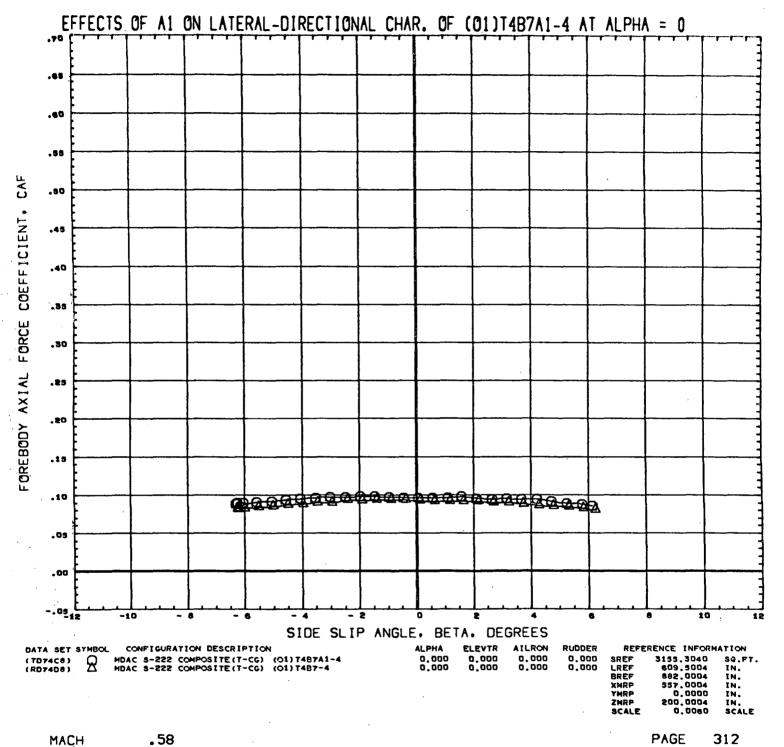






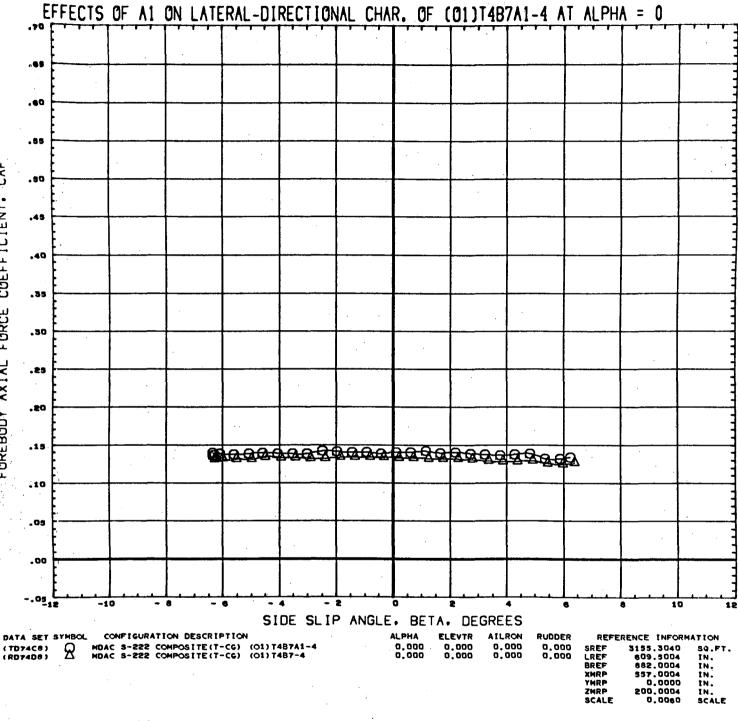






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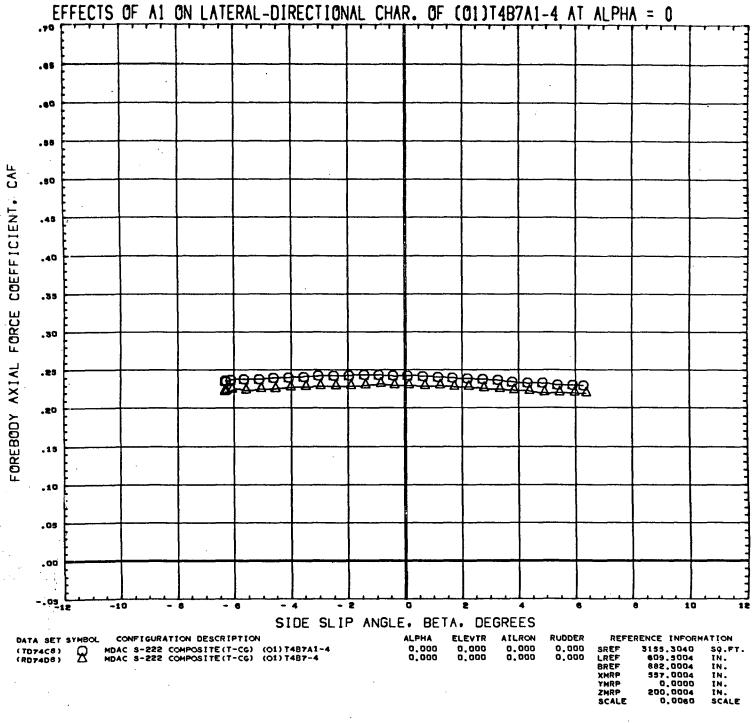
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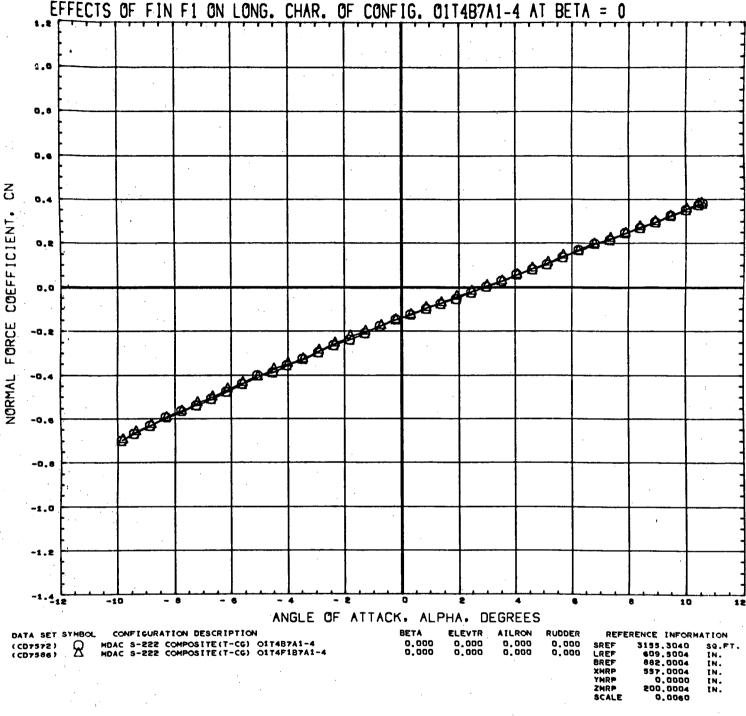


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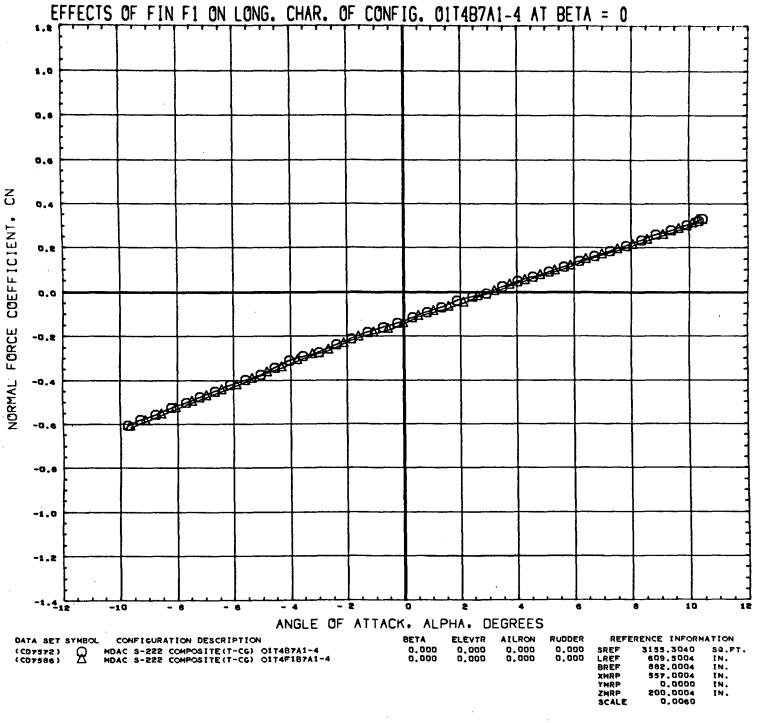
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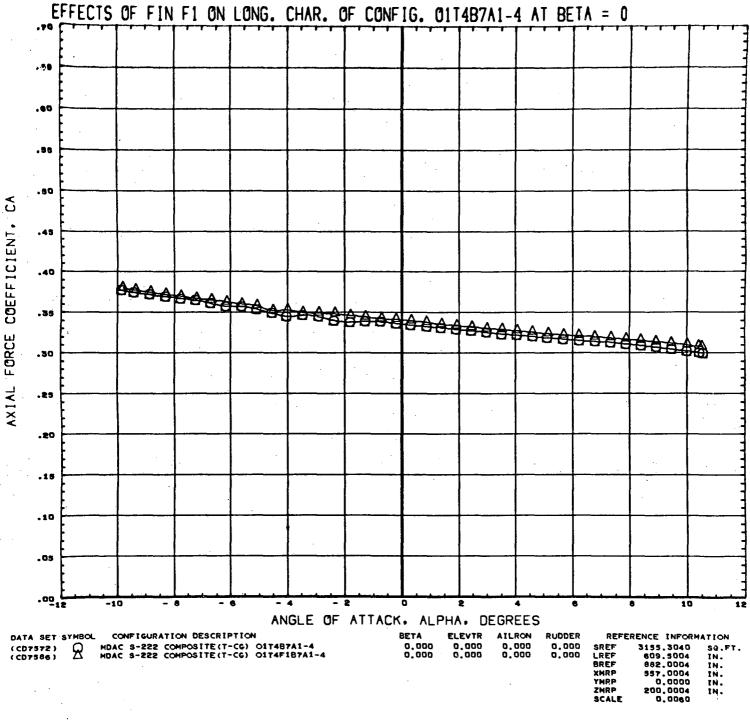
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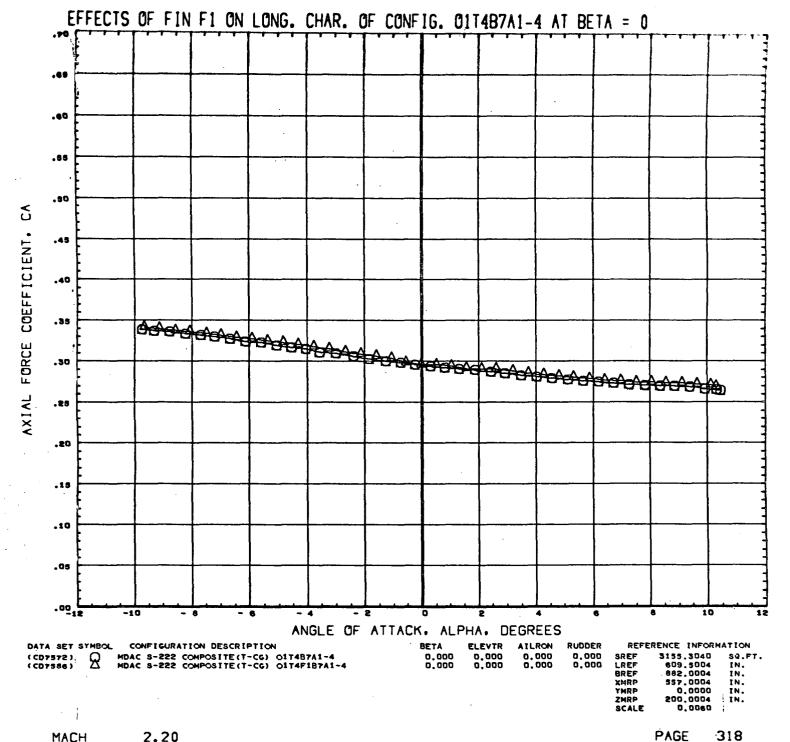
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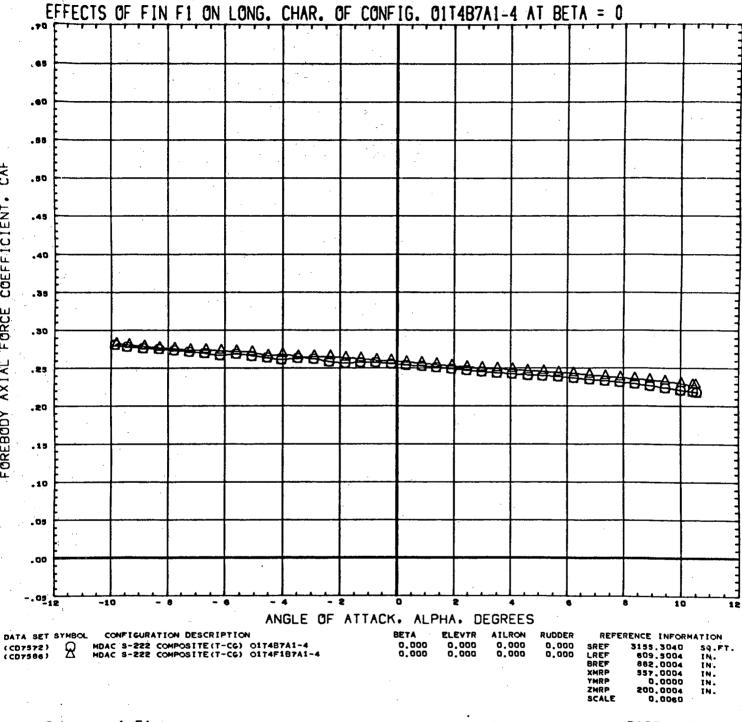


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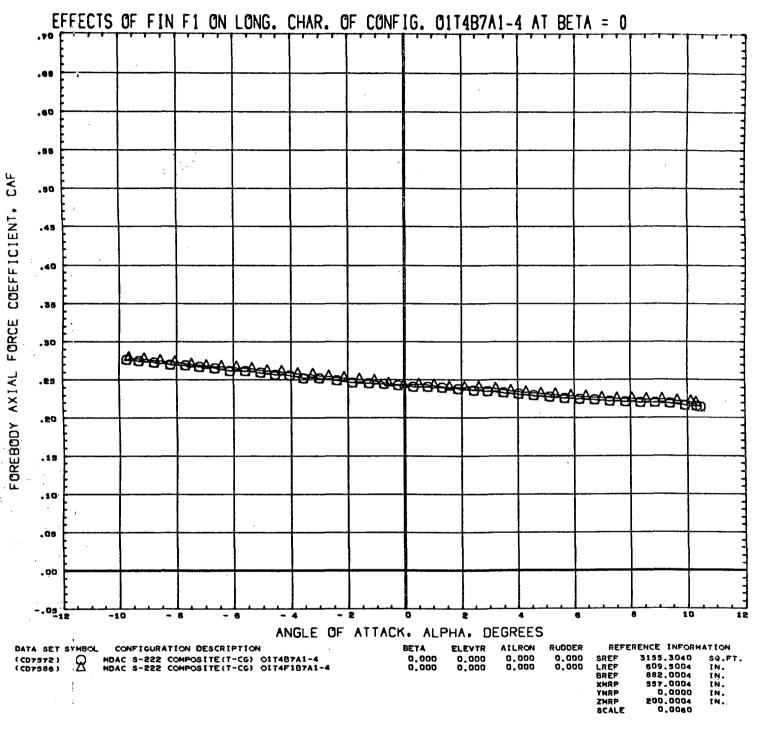


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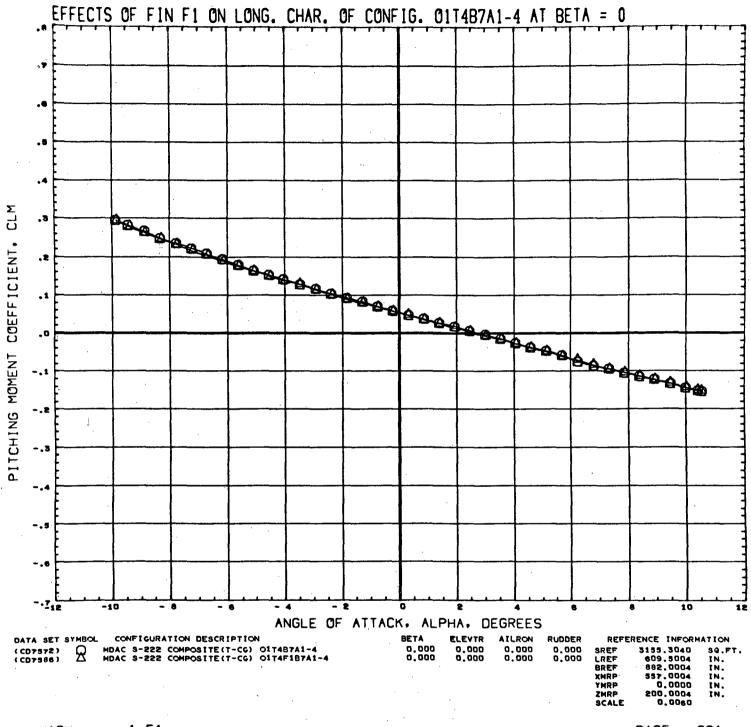
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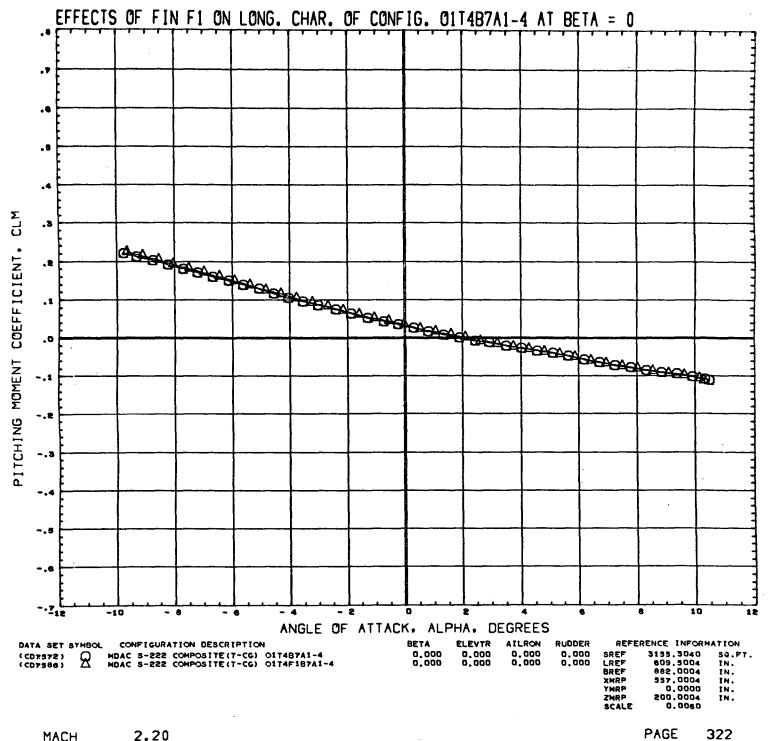
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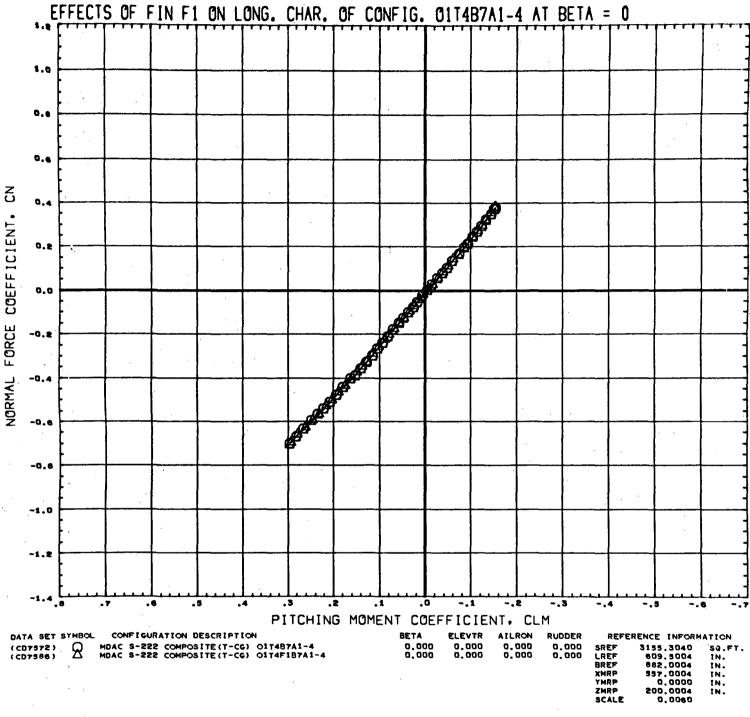
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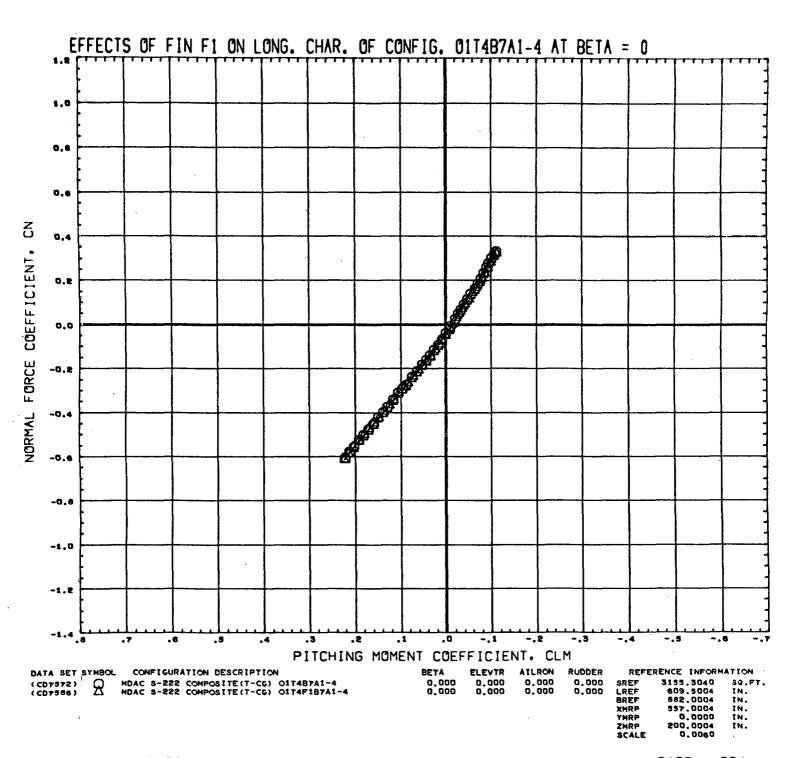
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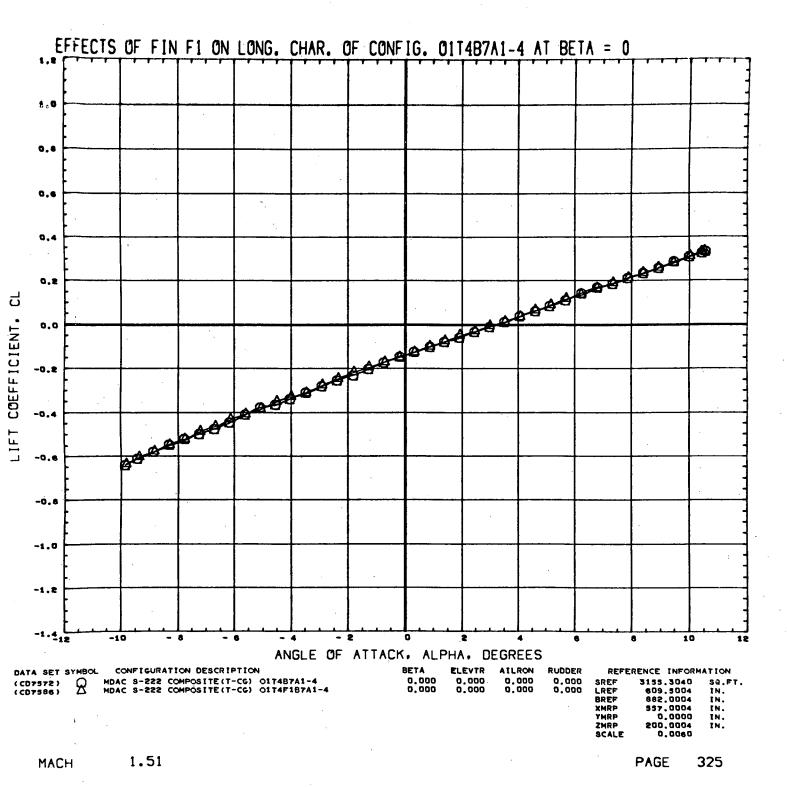


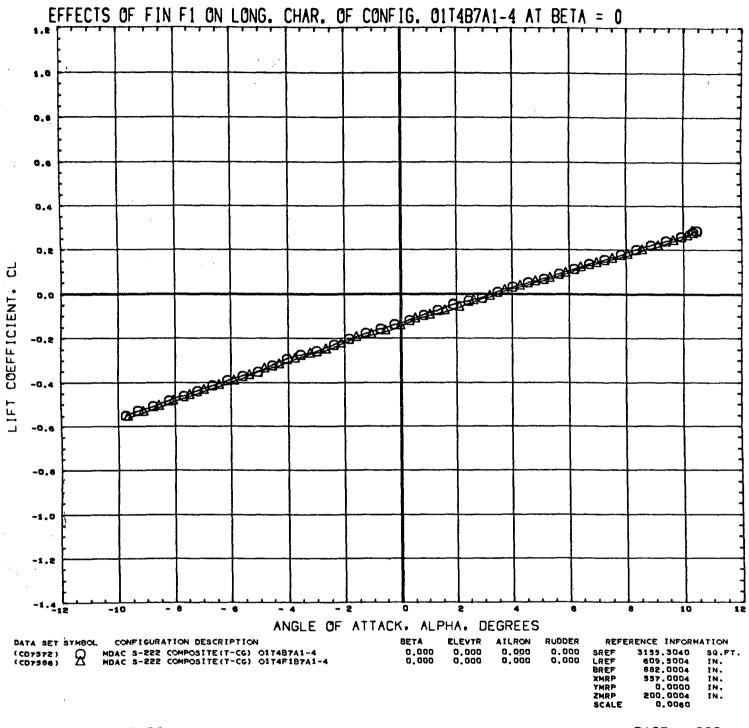


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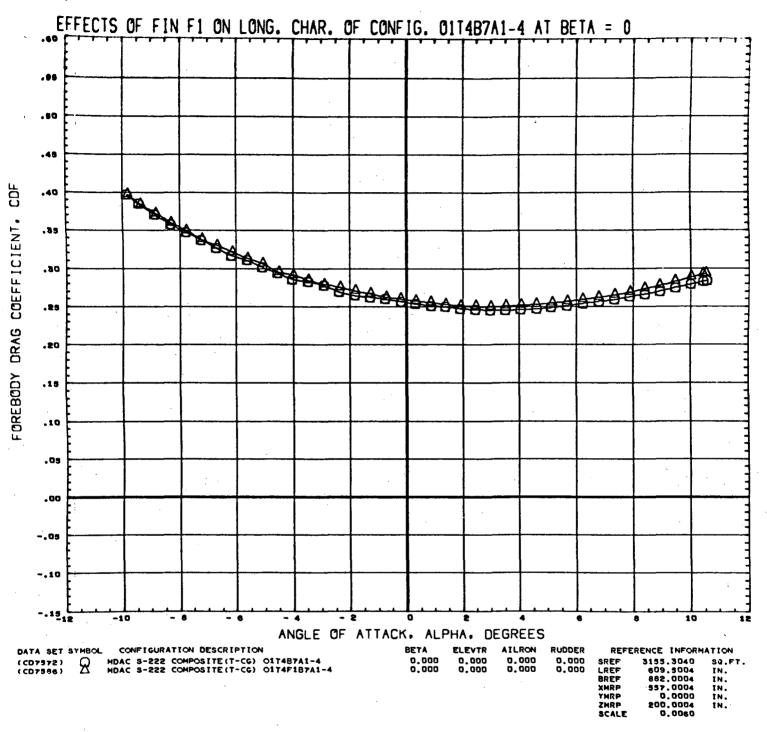




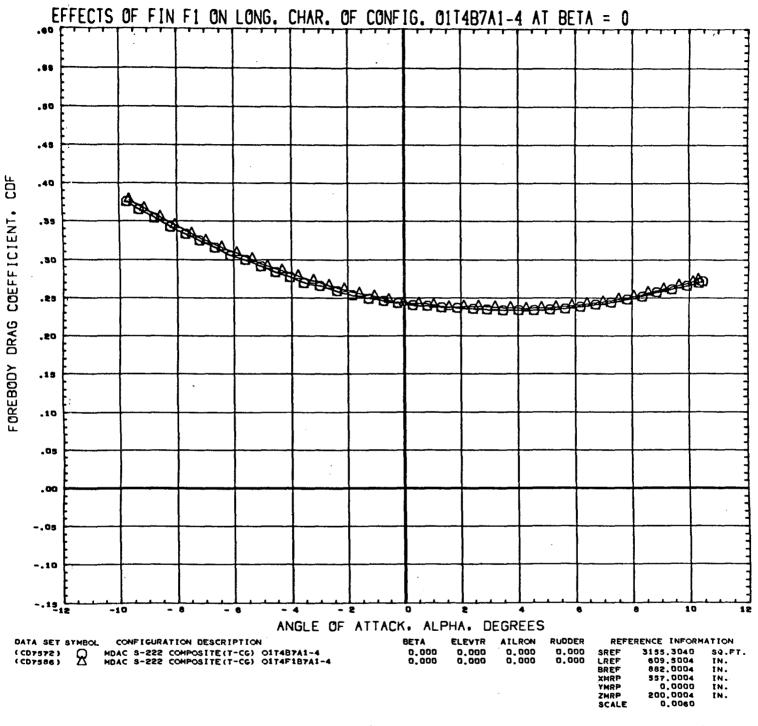




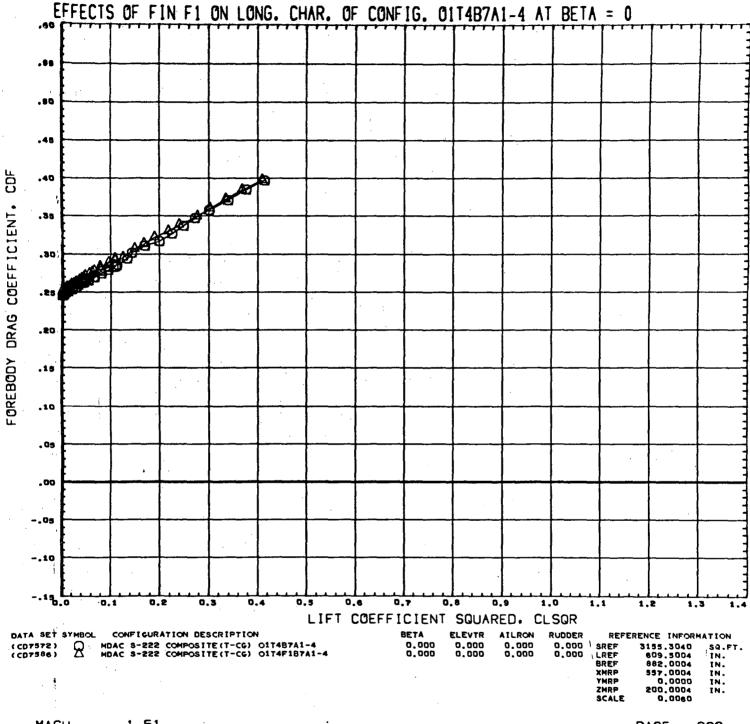
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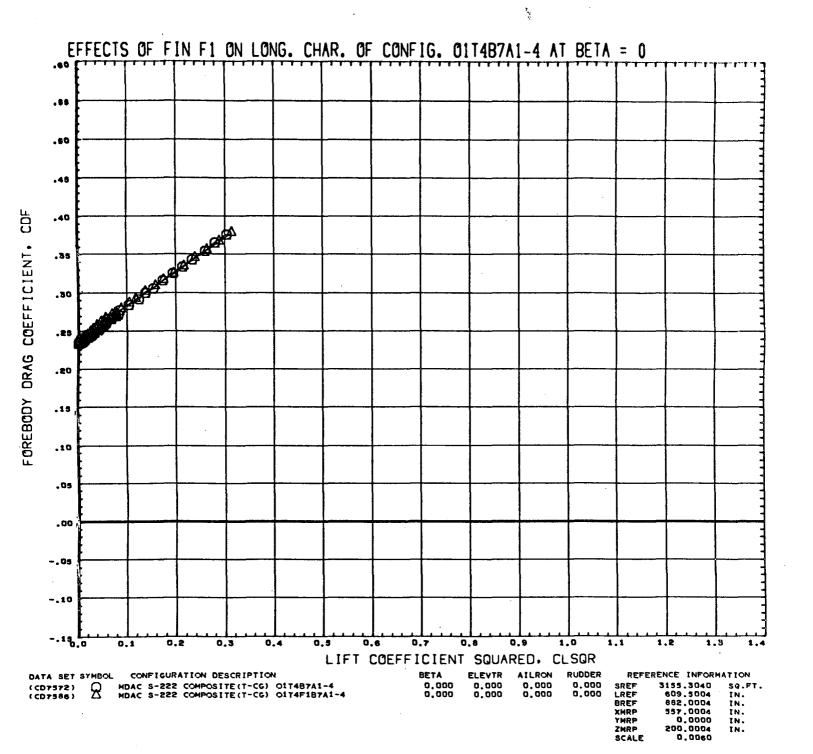


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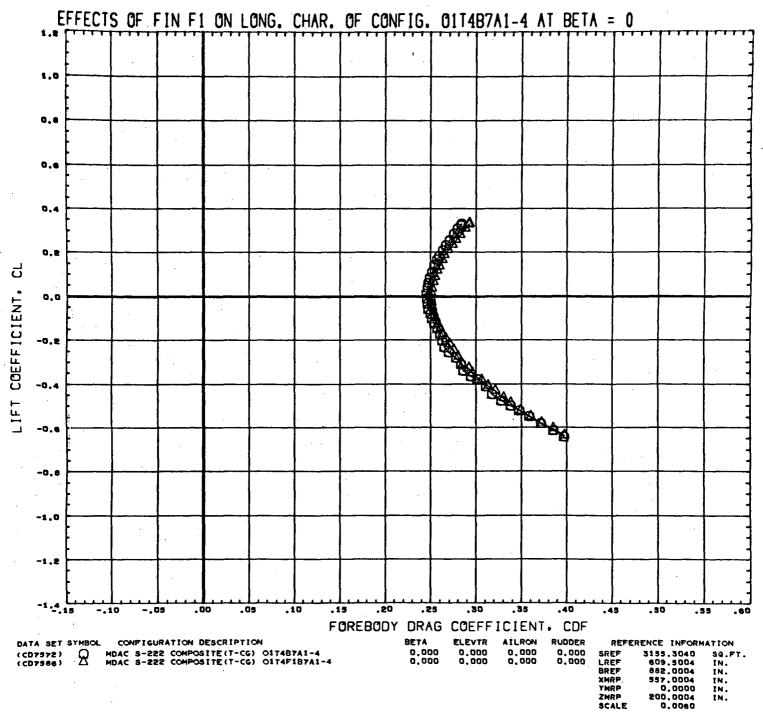


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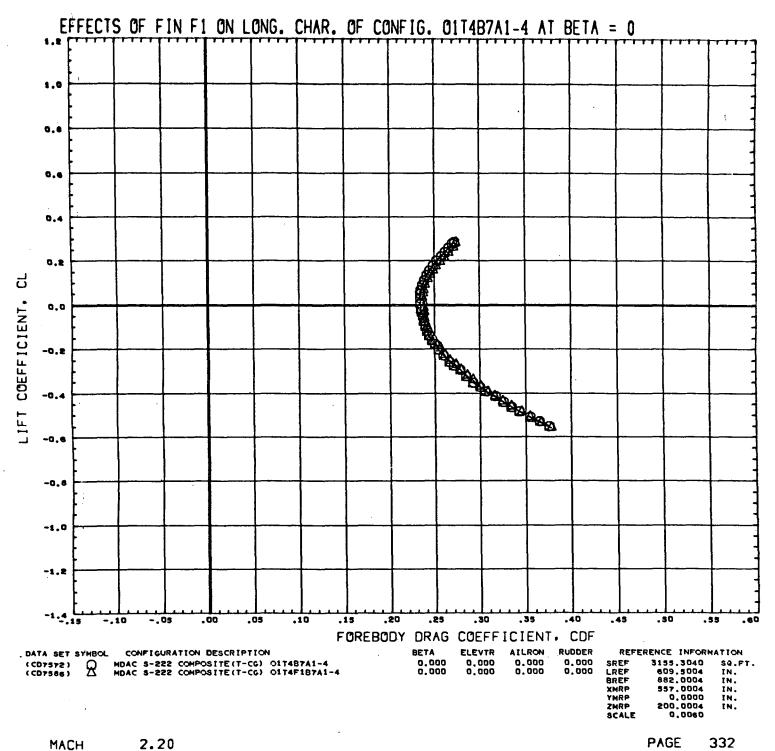


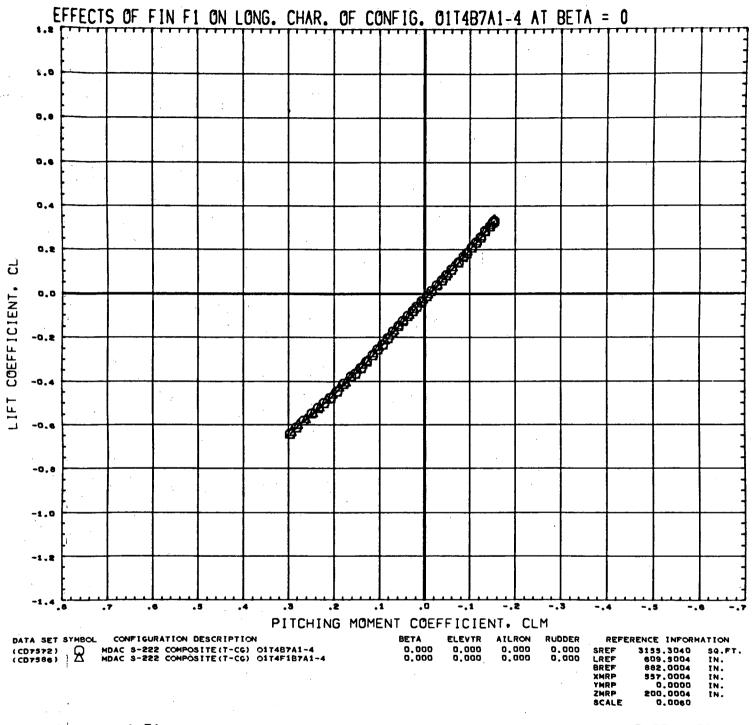
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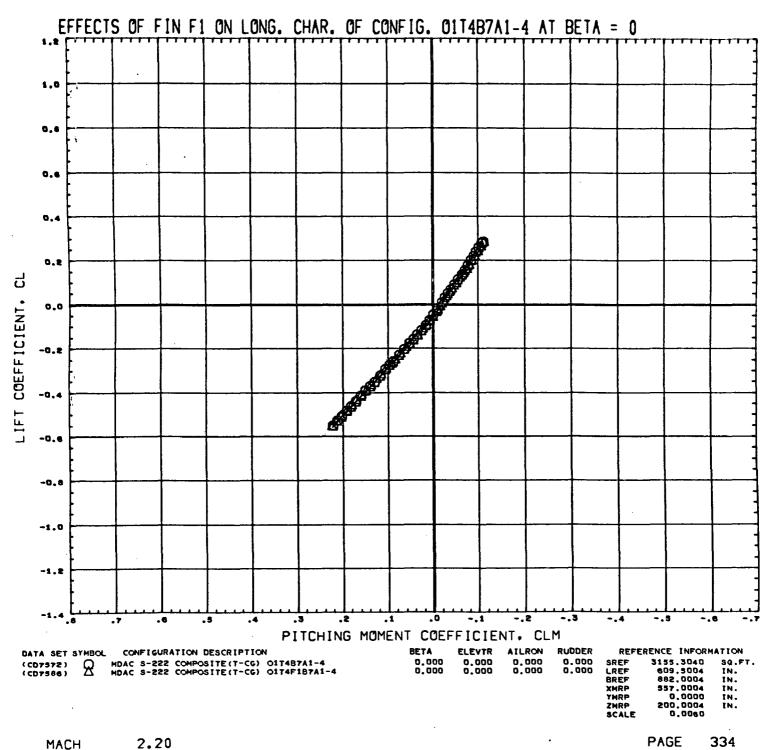
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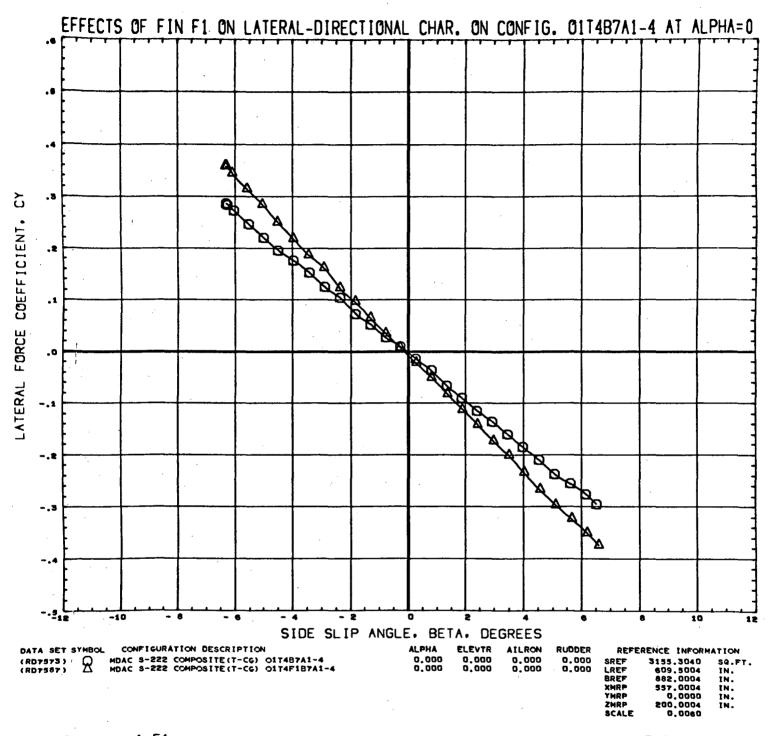


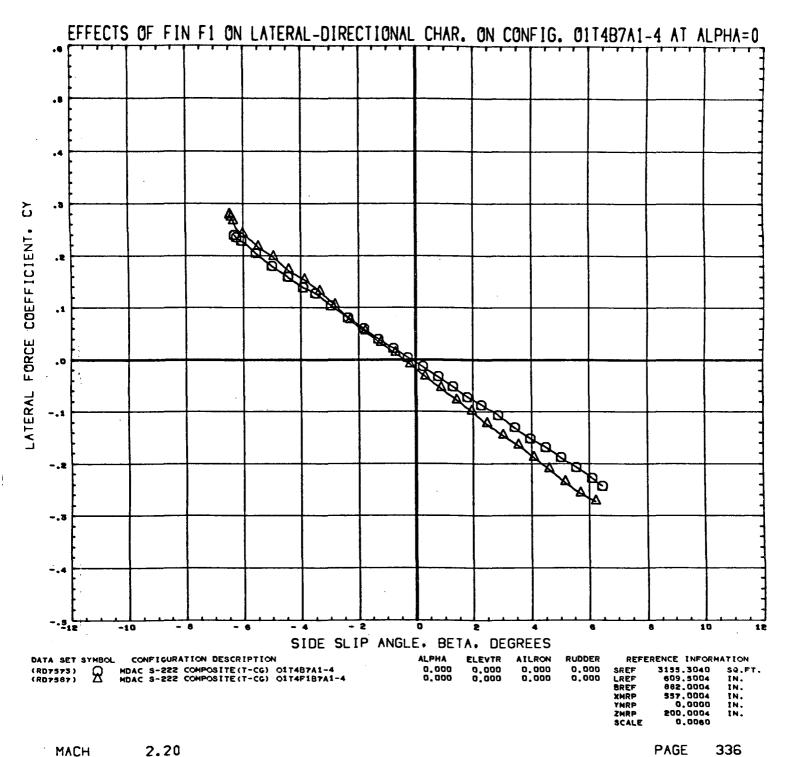
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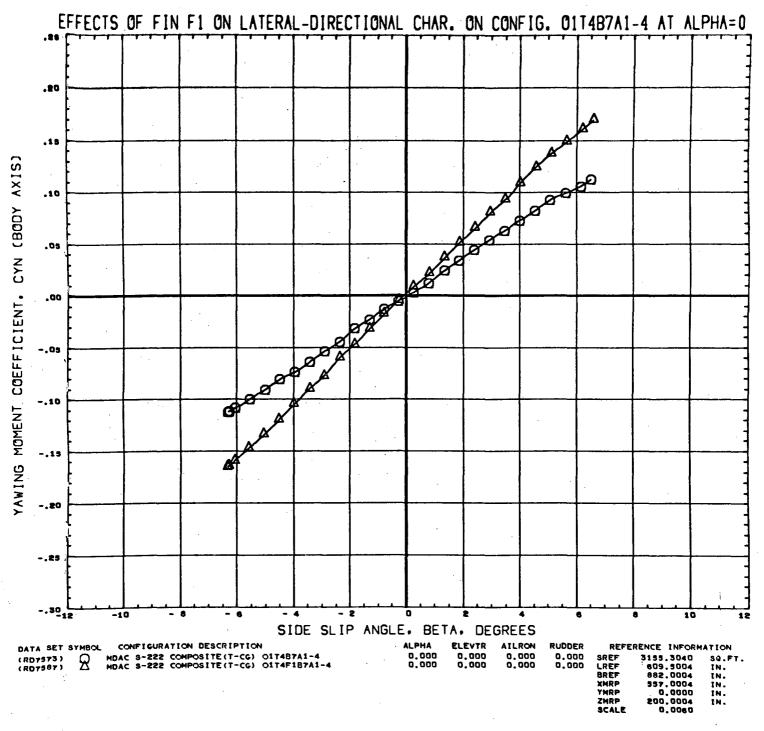


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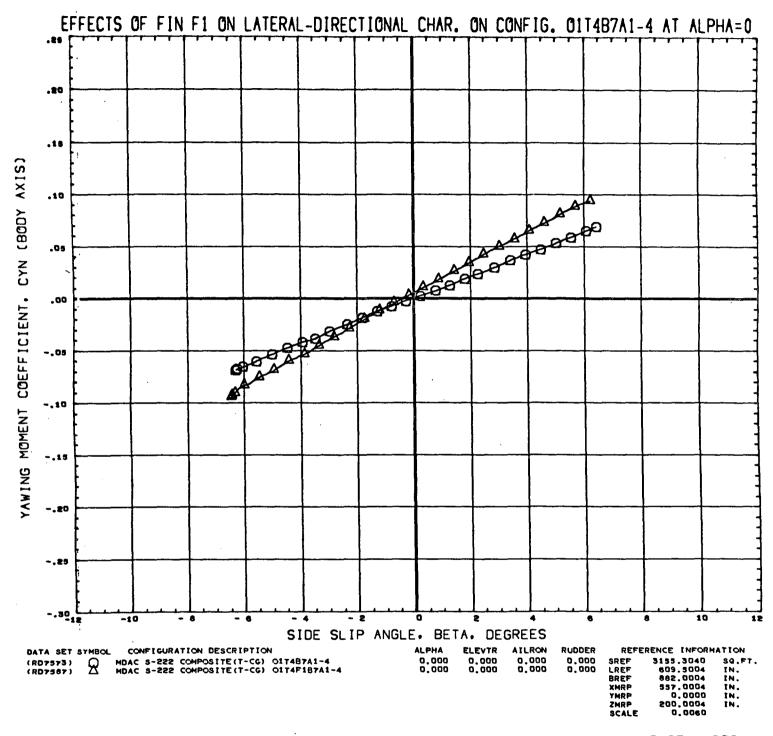




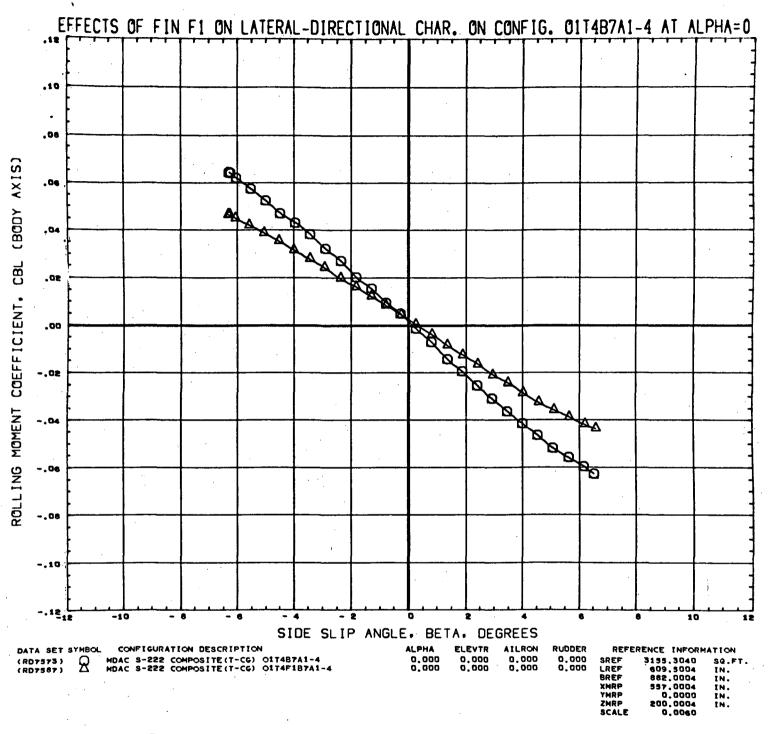
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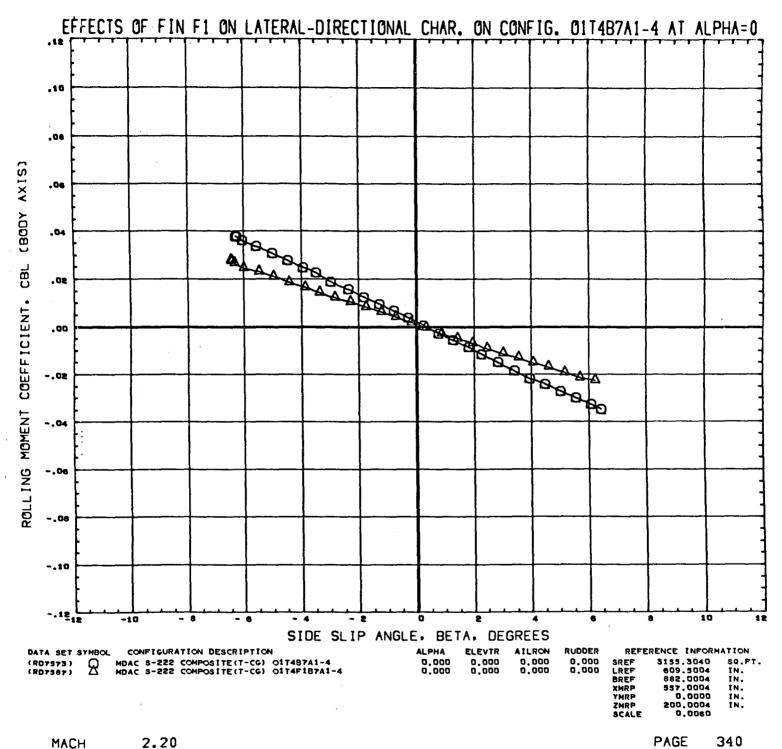


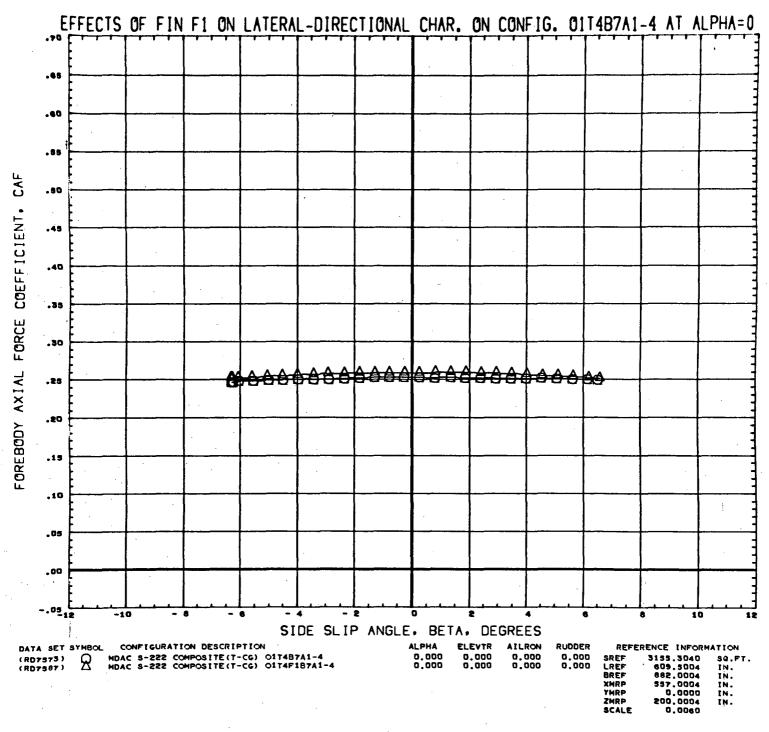
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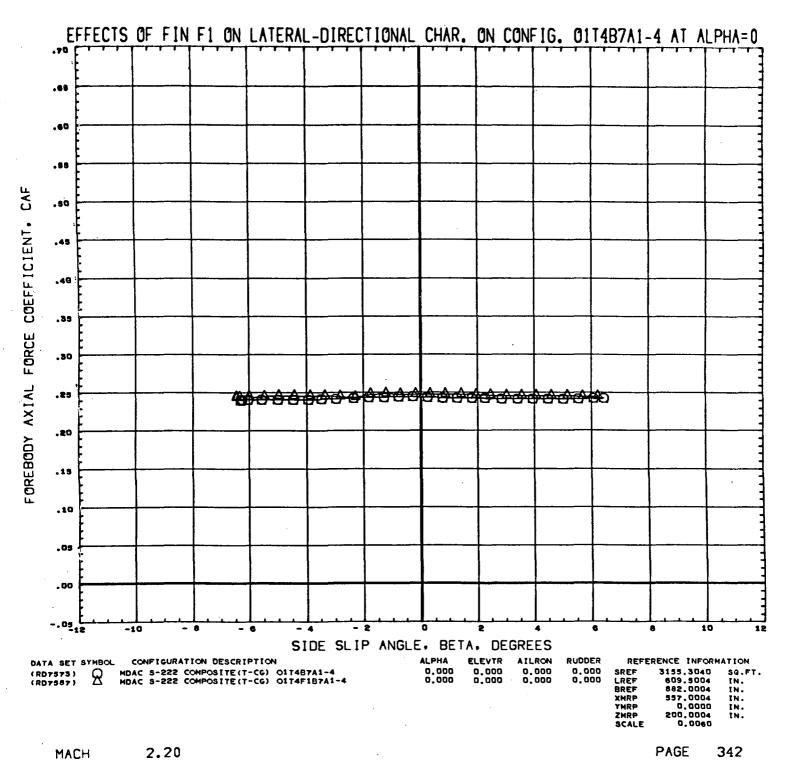


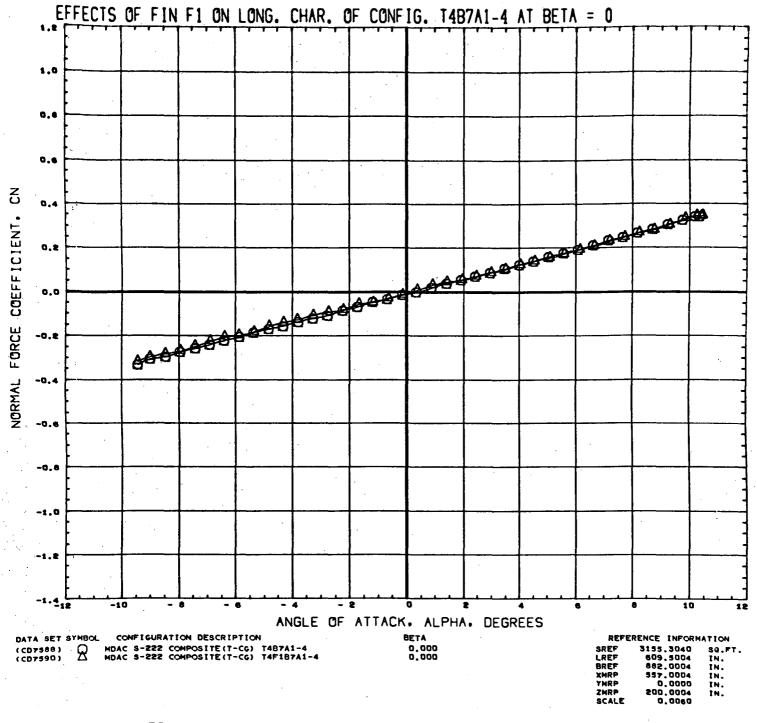
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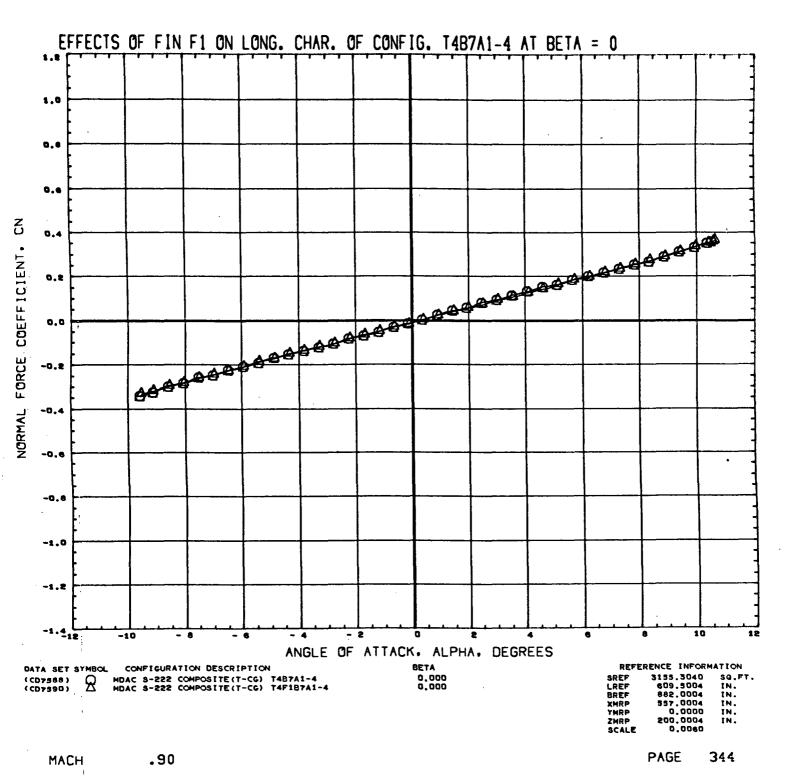


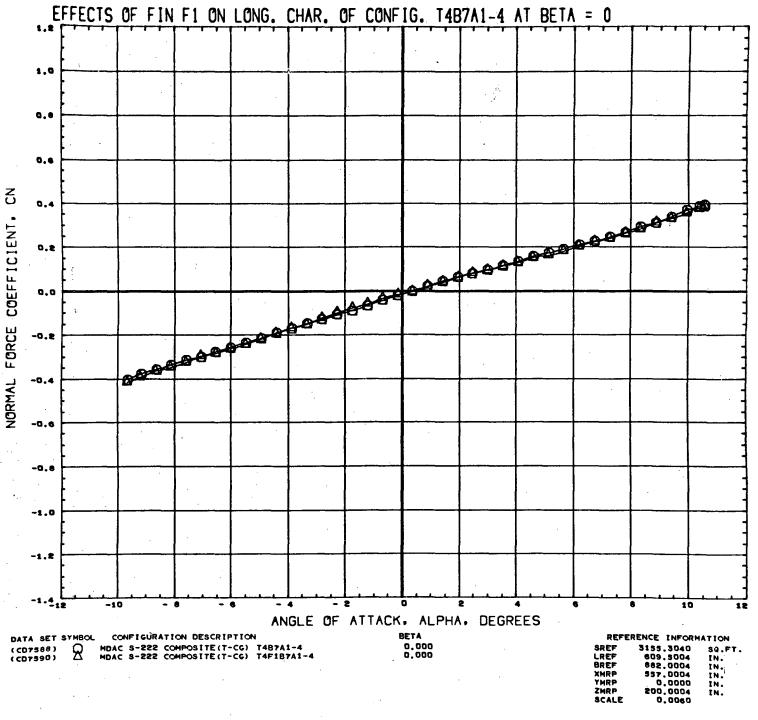




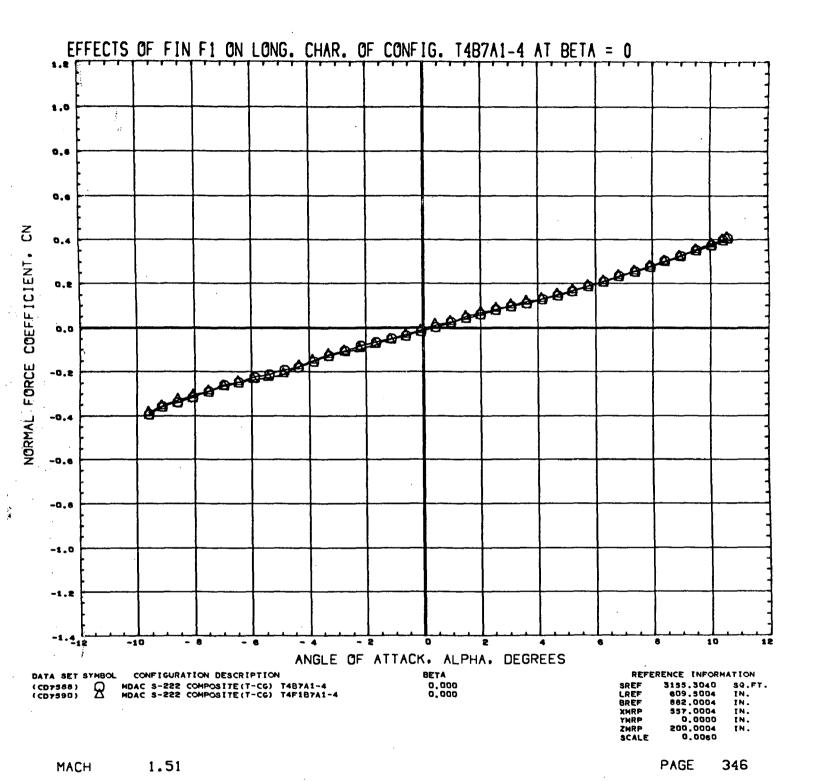


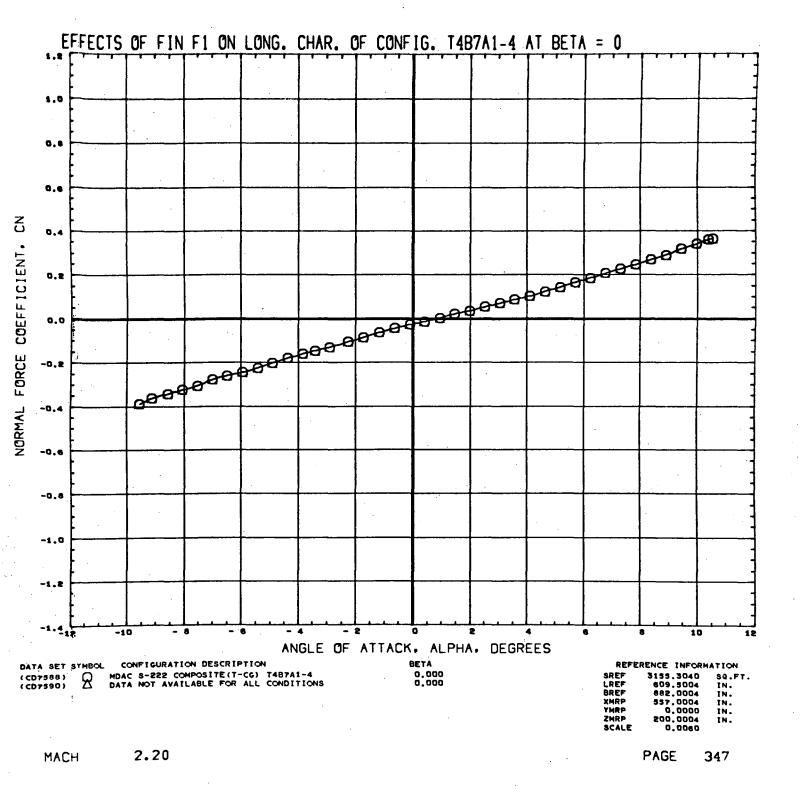


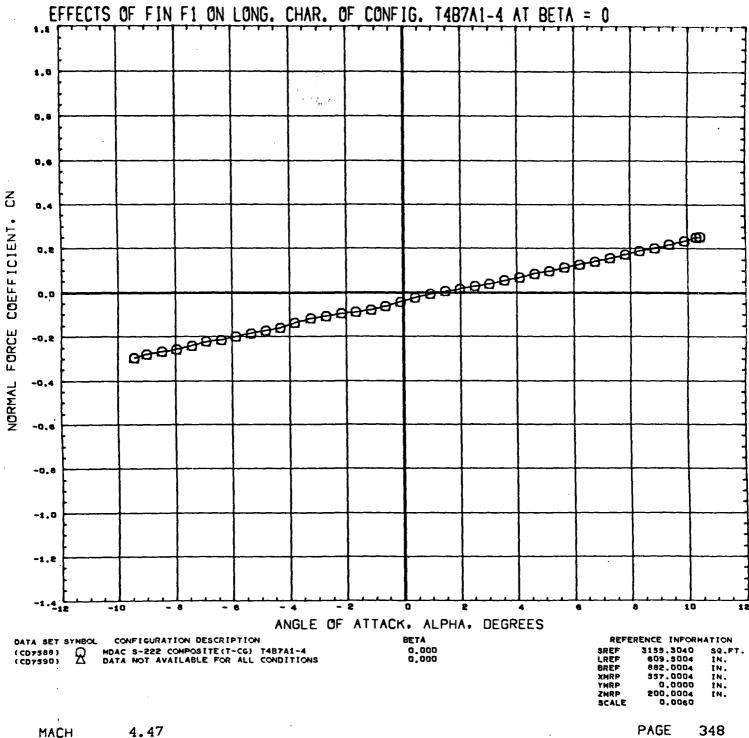




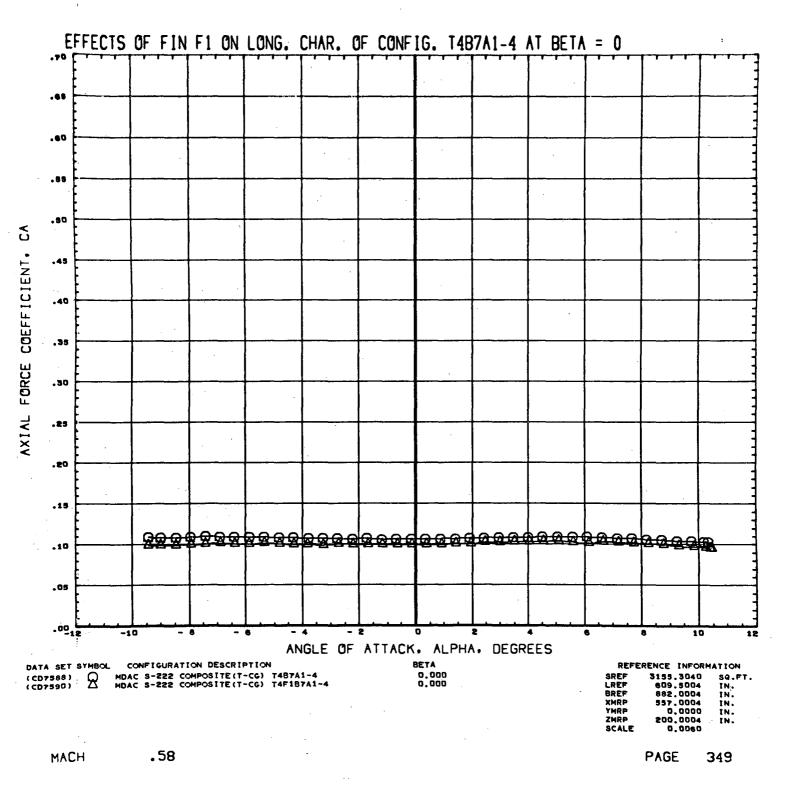
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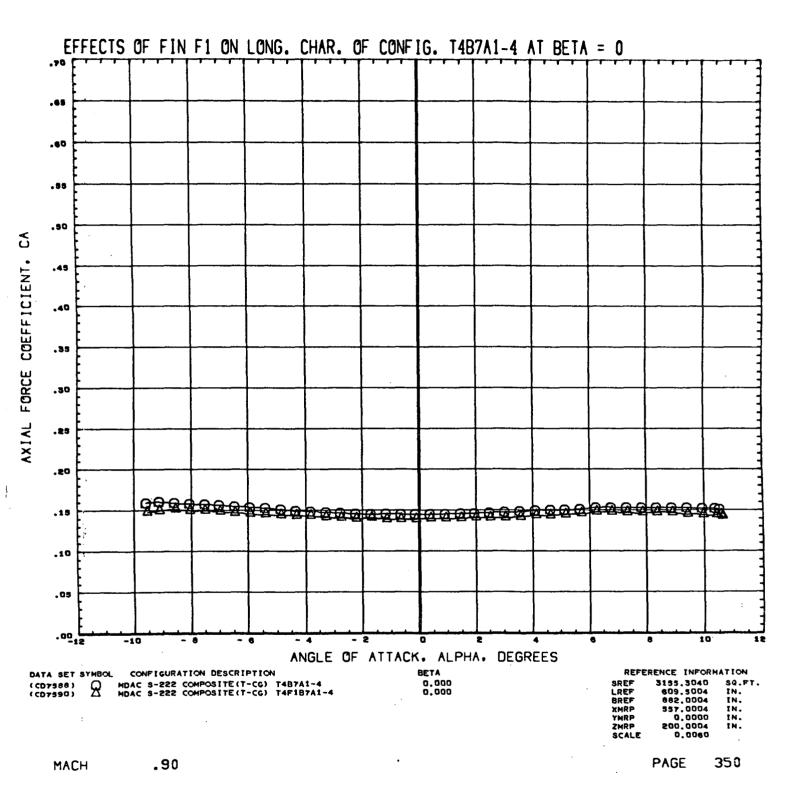


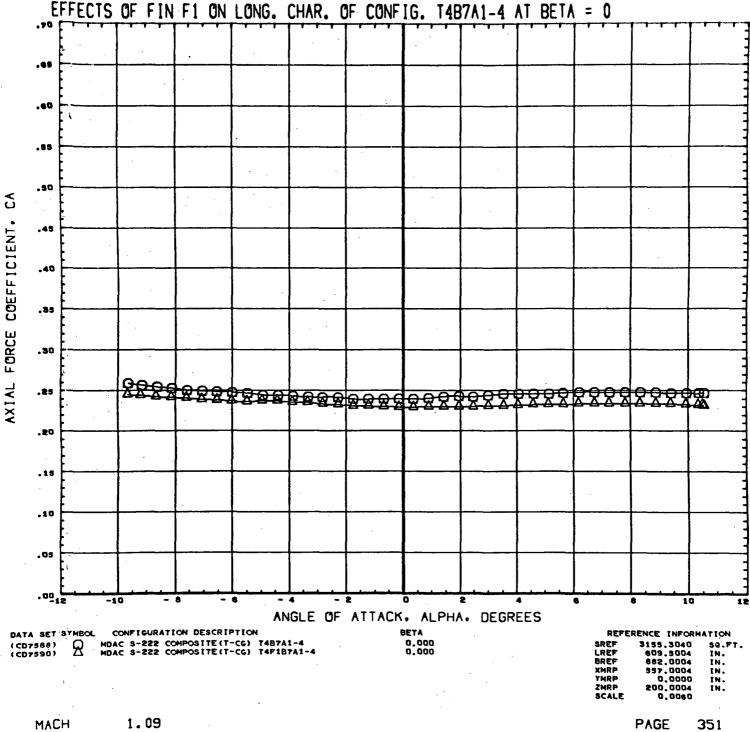




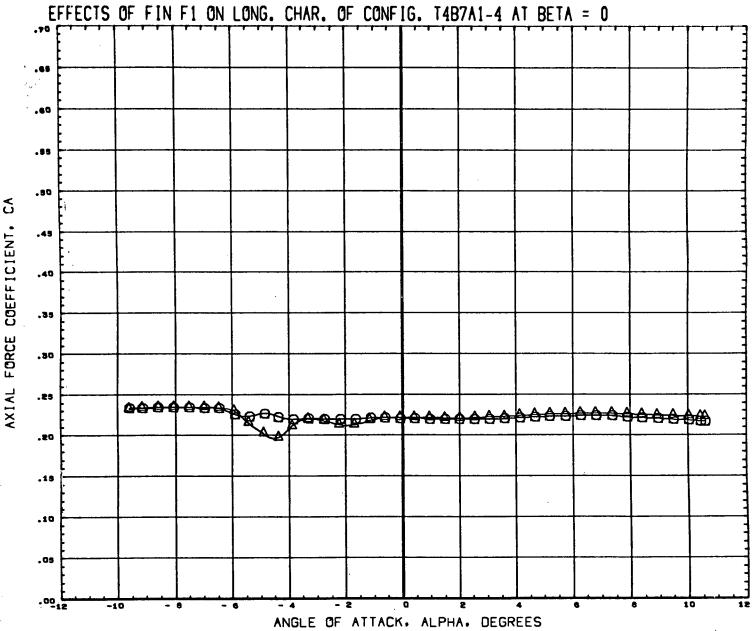
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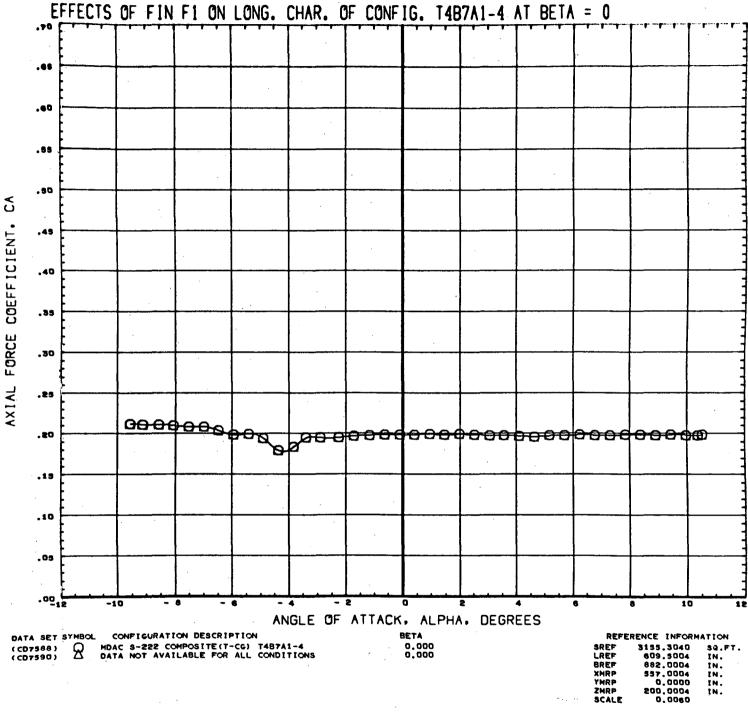


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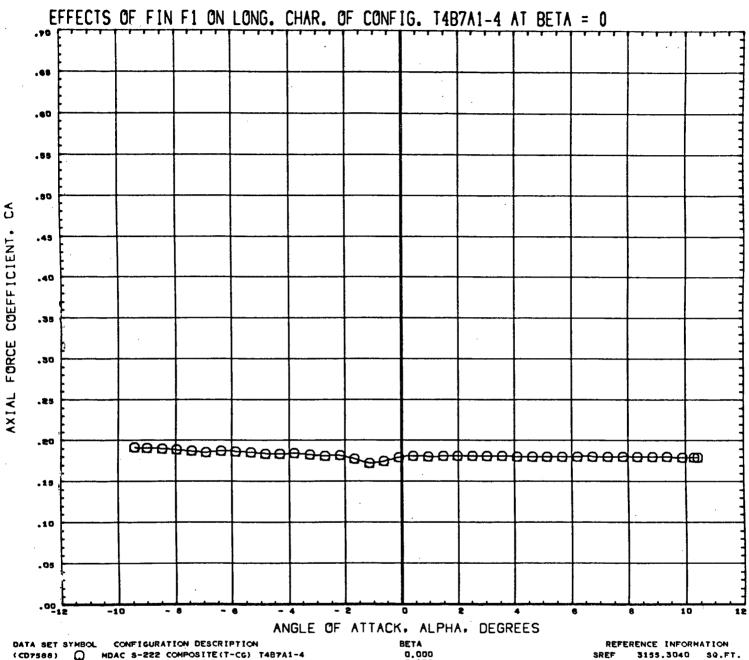


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MACH 1.51



MACH 2.20



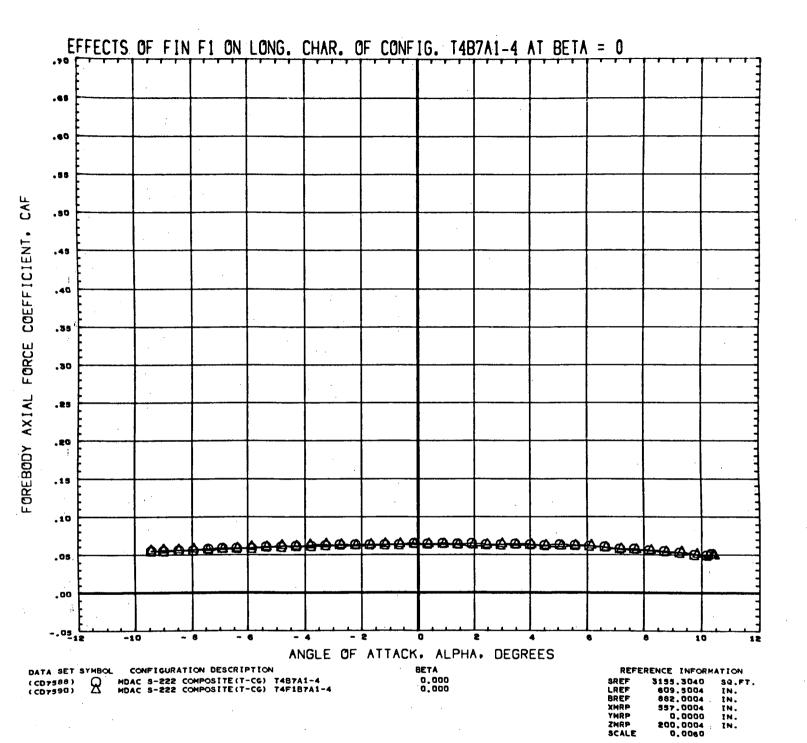
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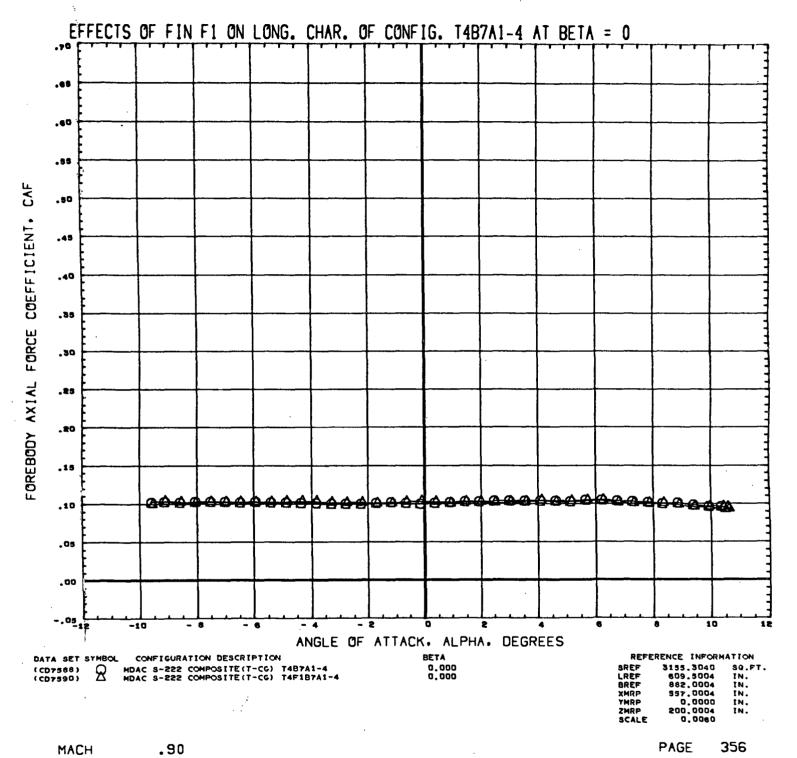
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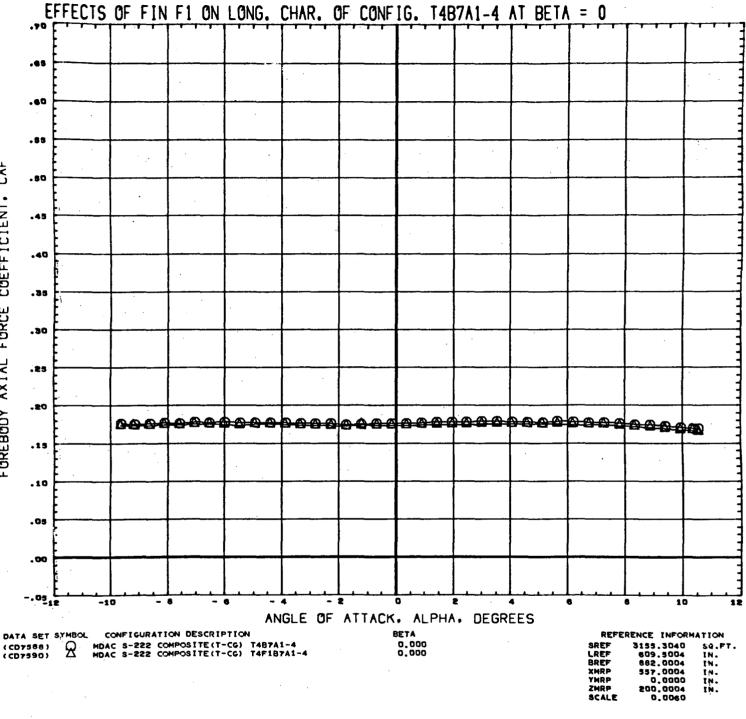
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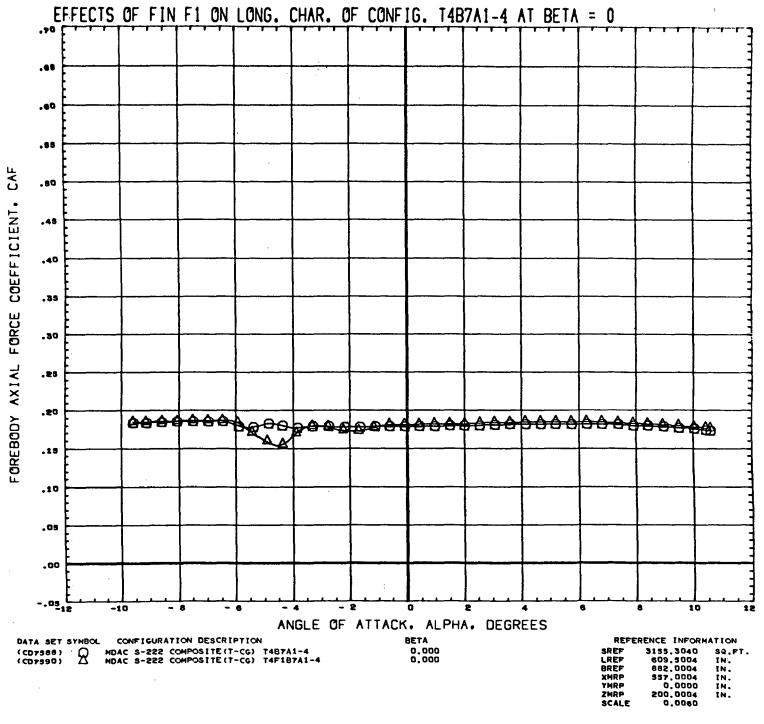
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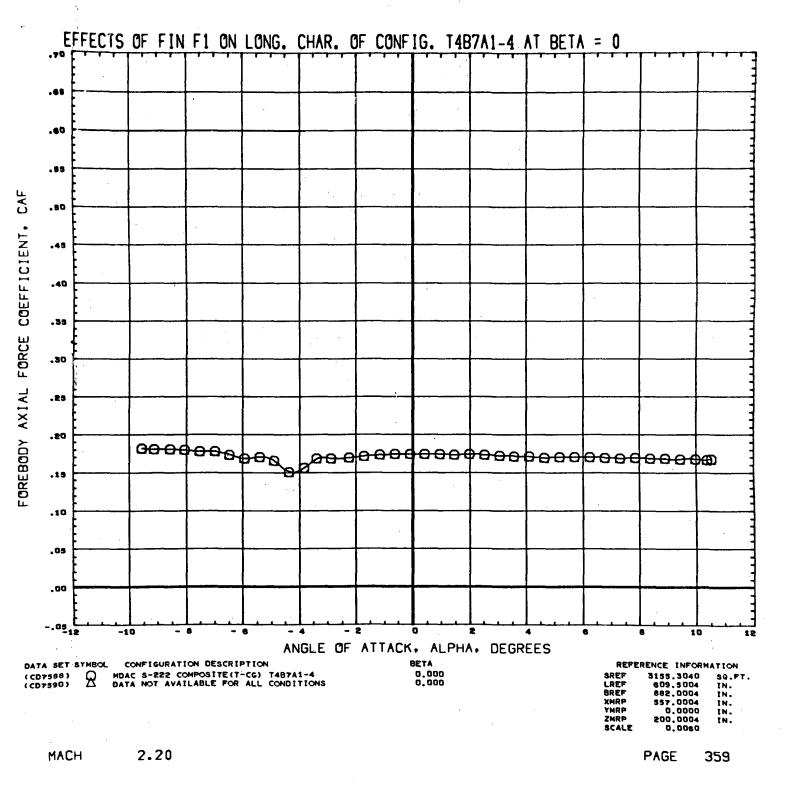


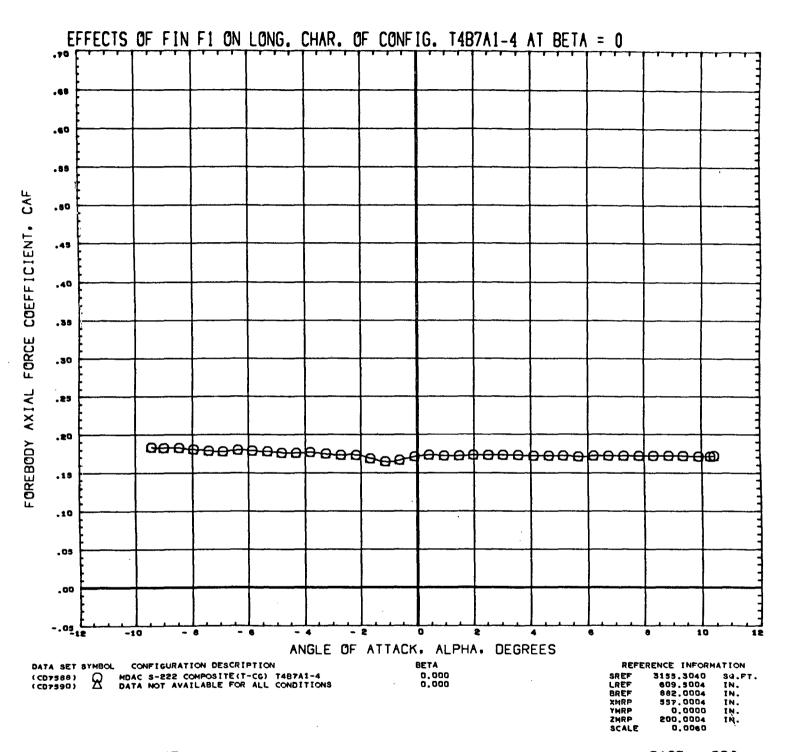
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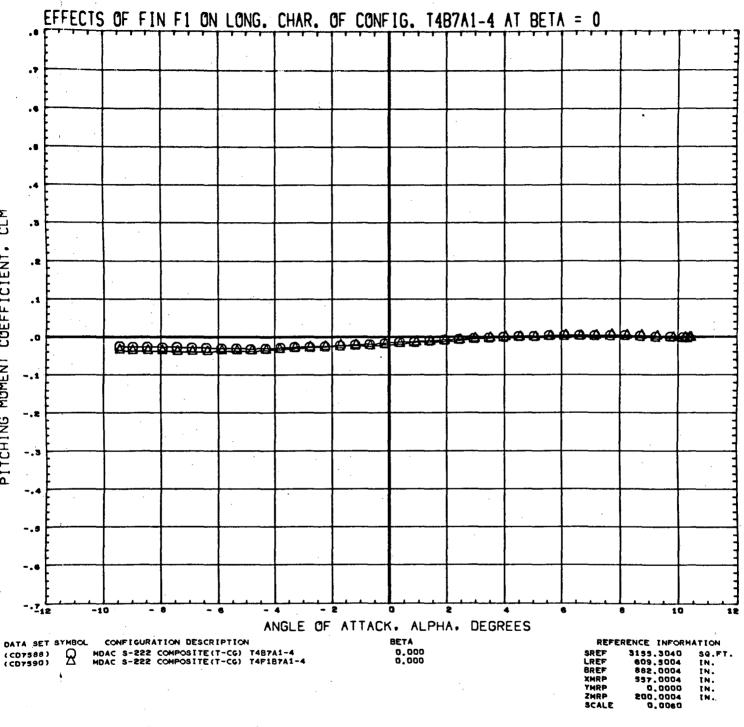
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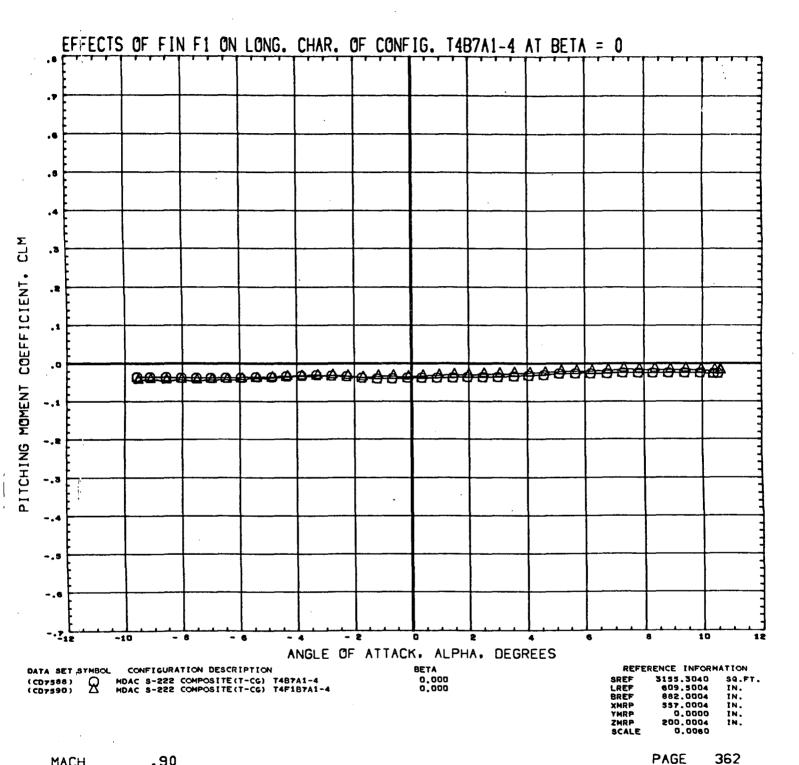
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MACH .58

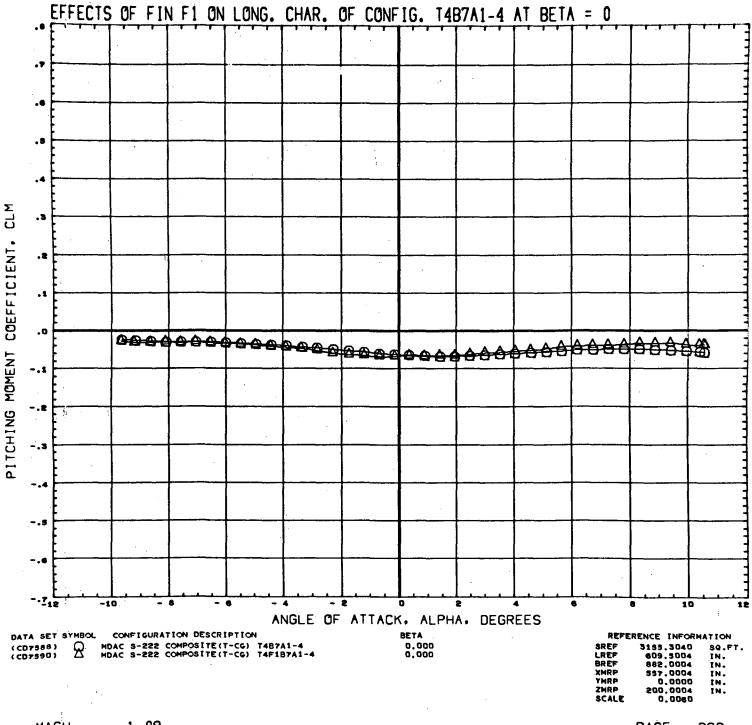
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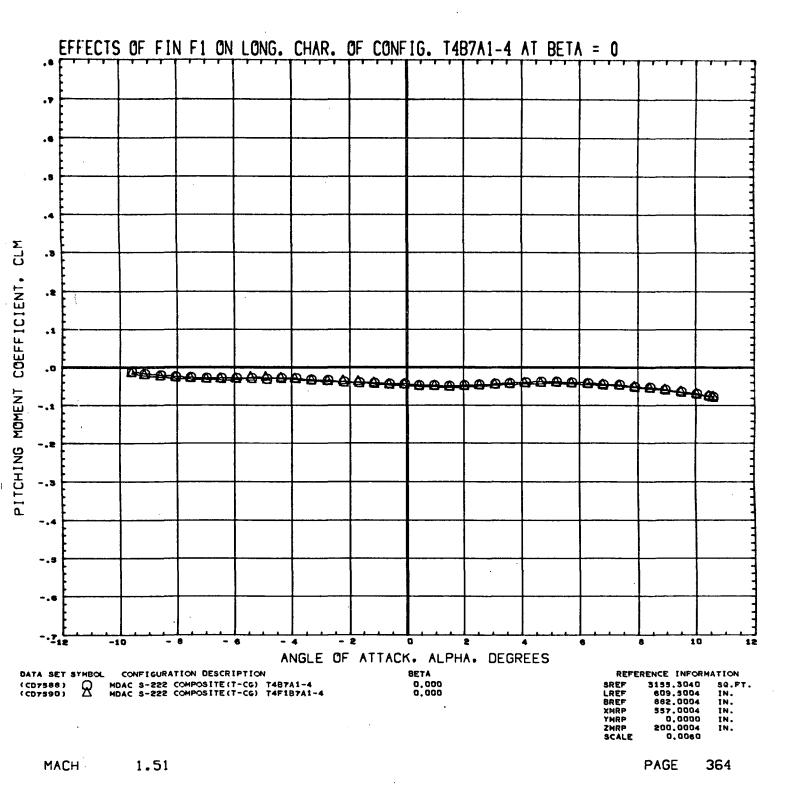
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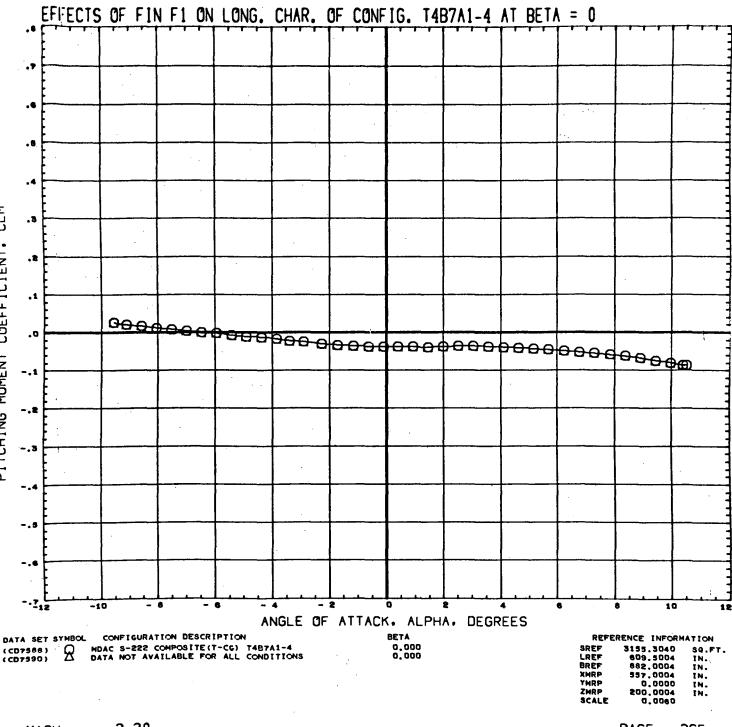


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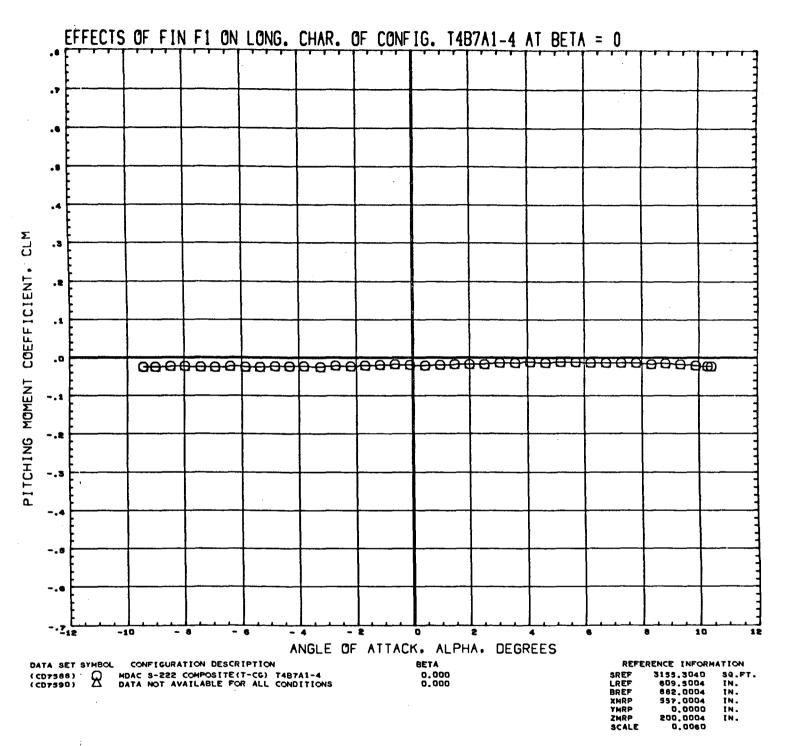


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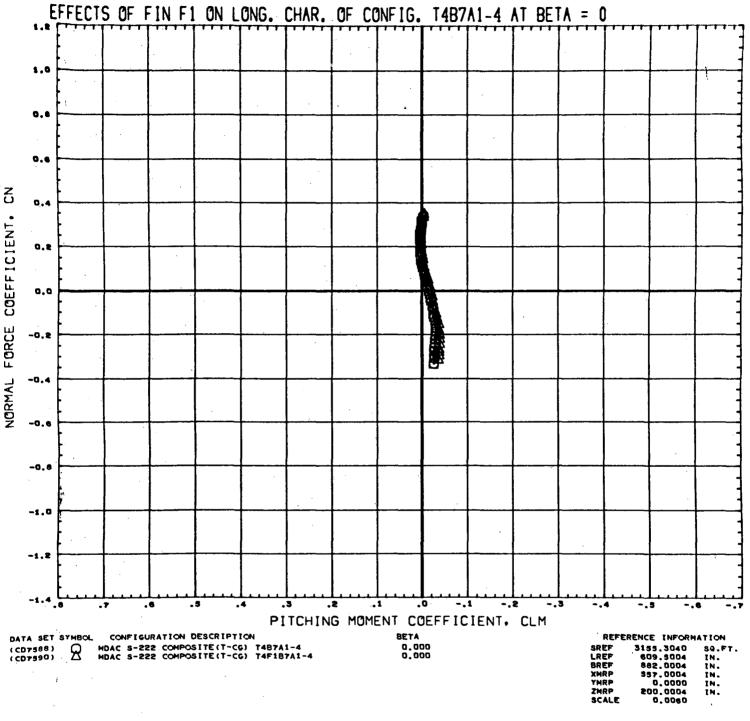
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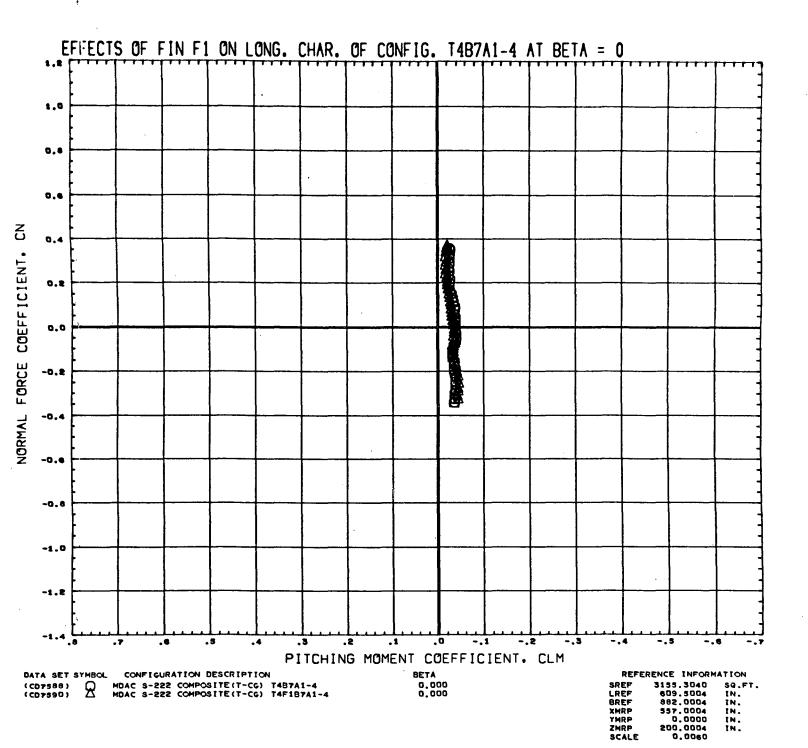
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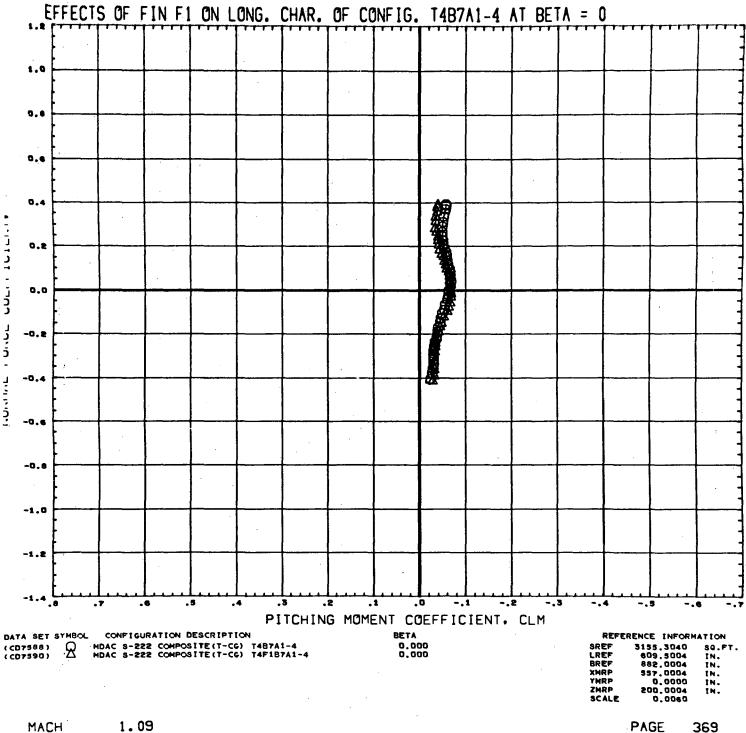


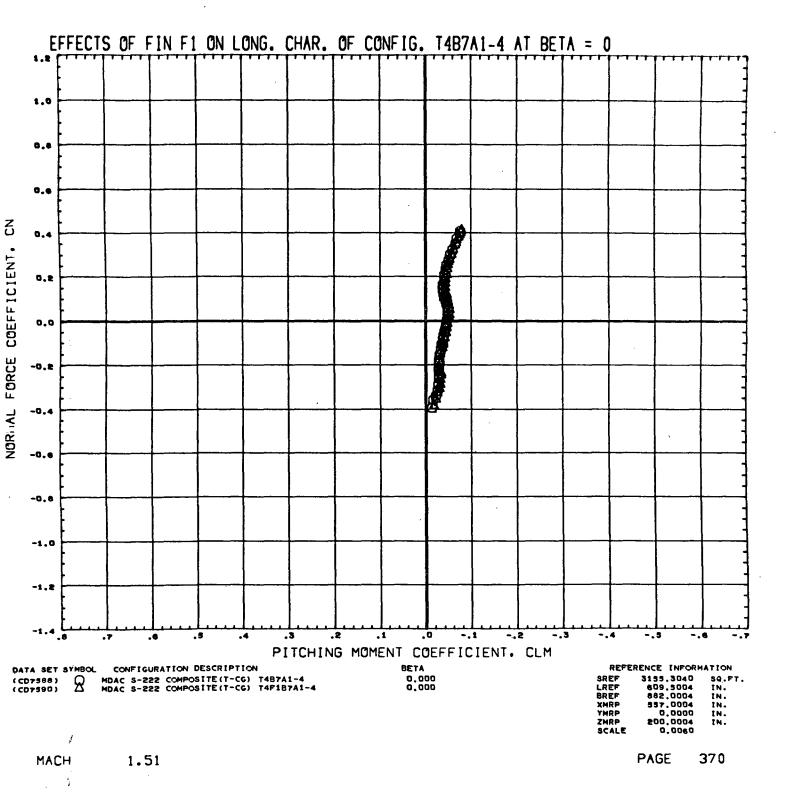


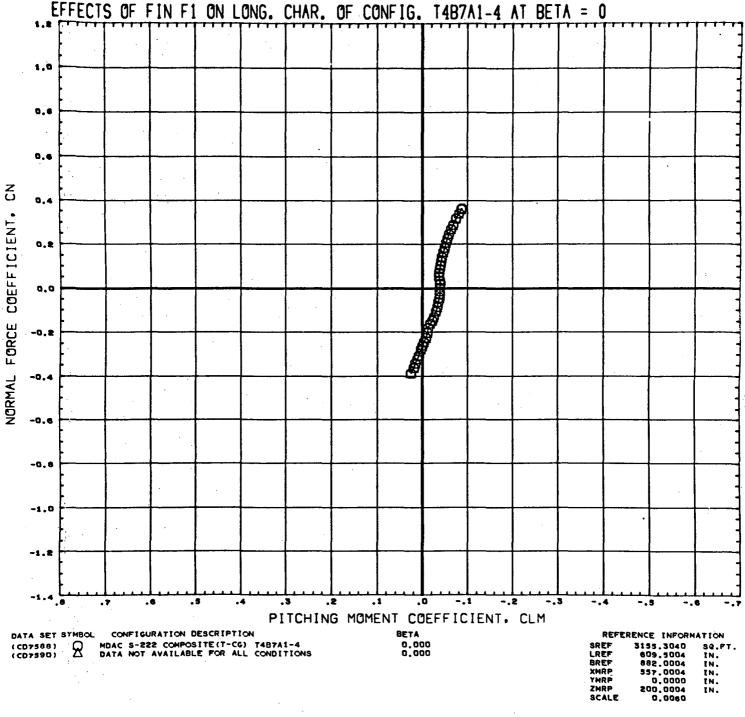
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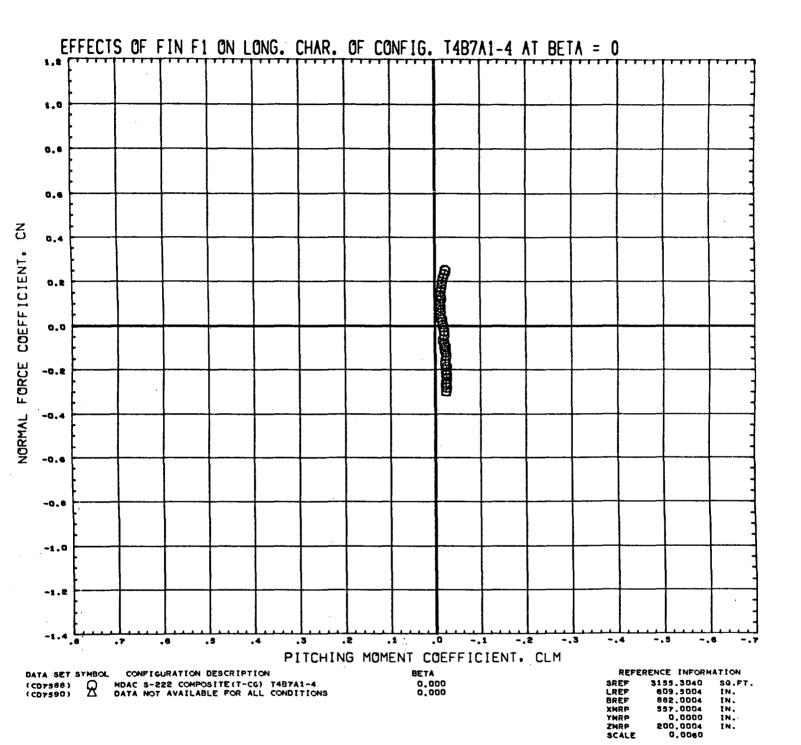
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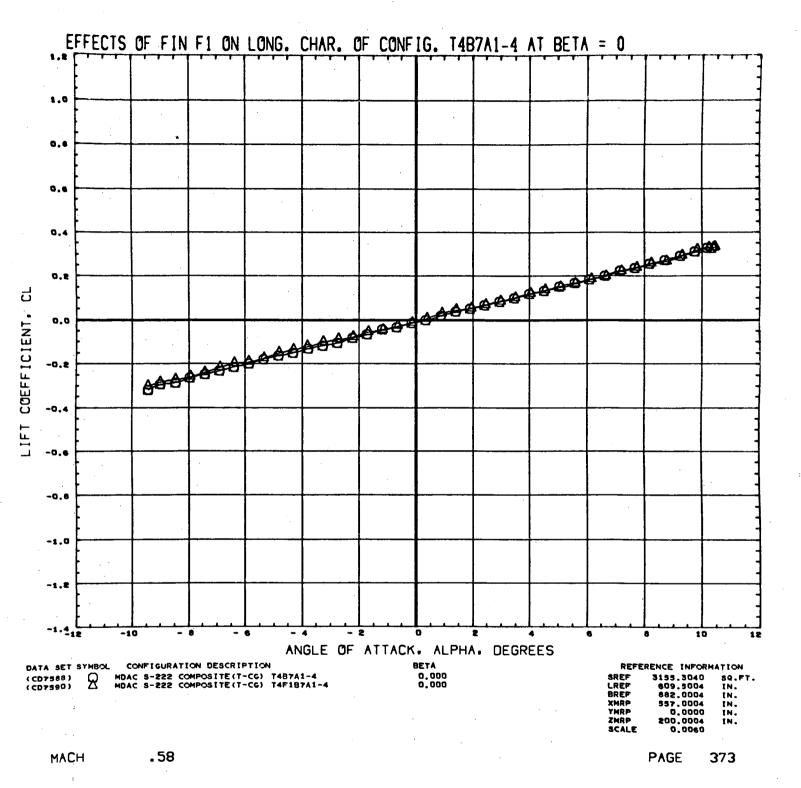


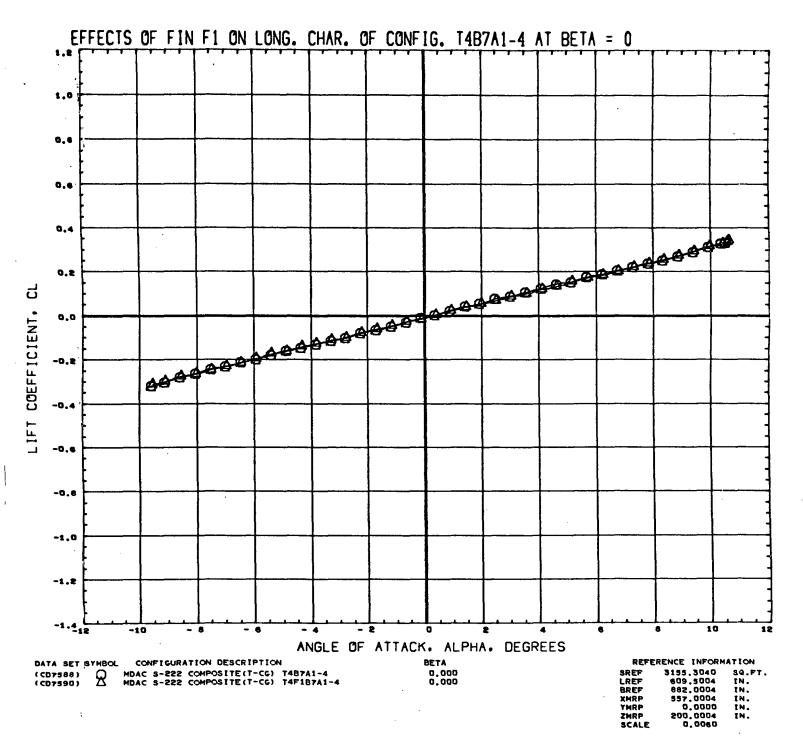


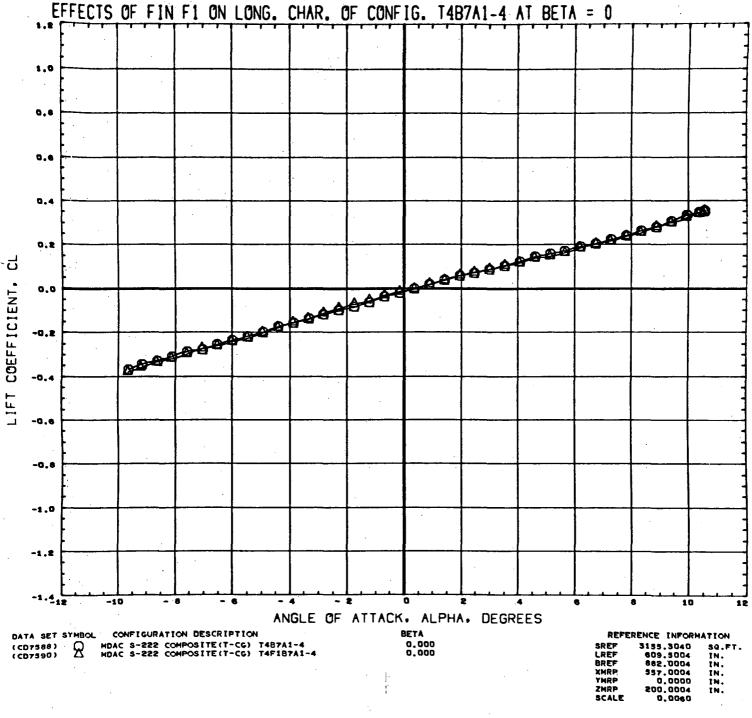
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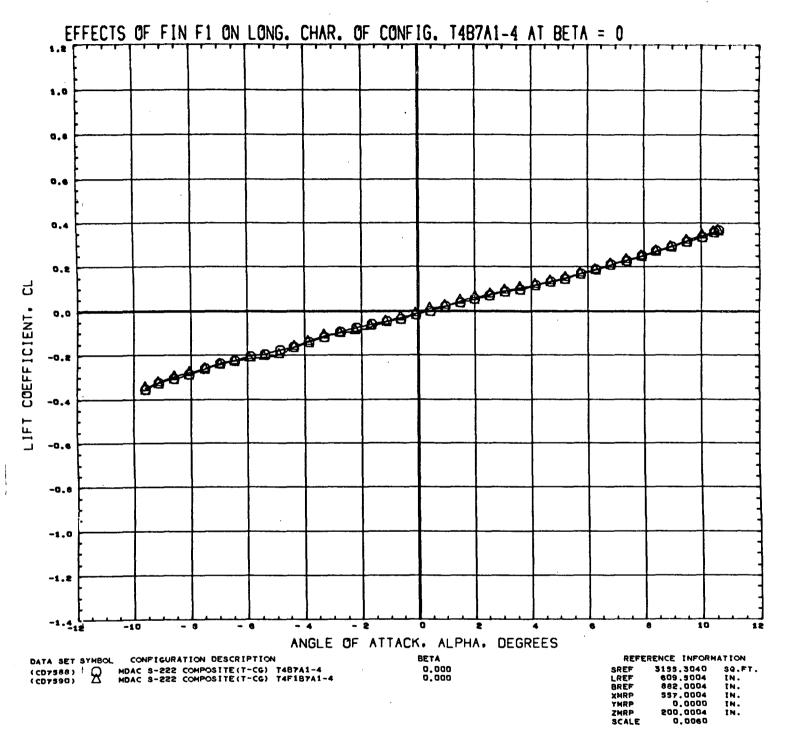


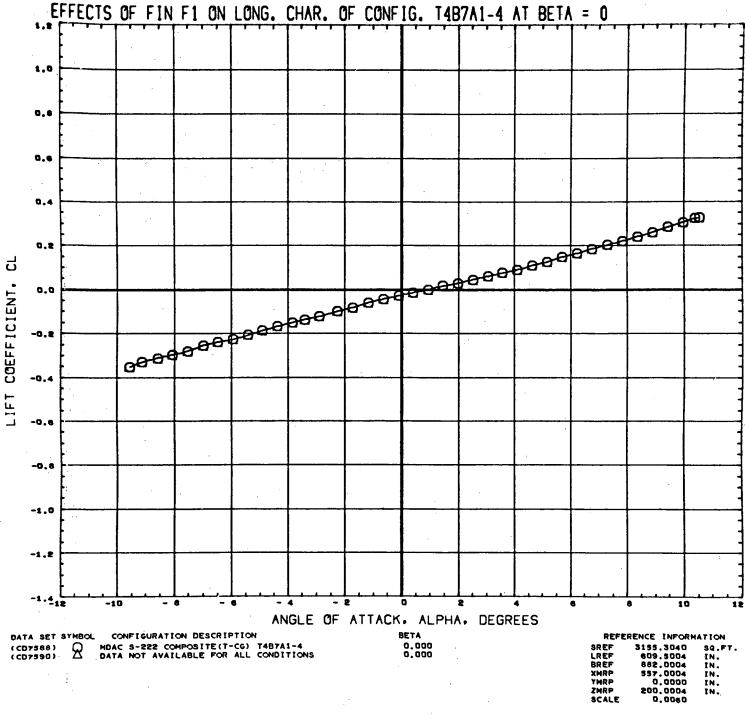
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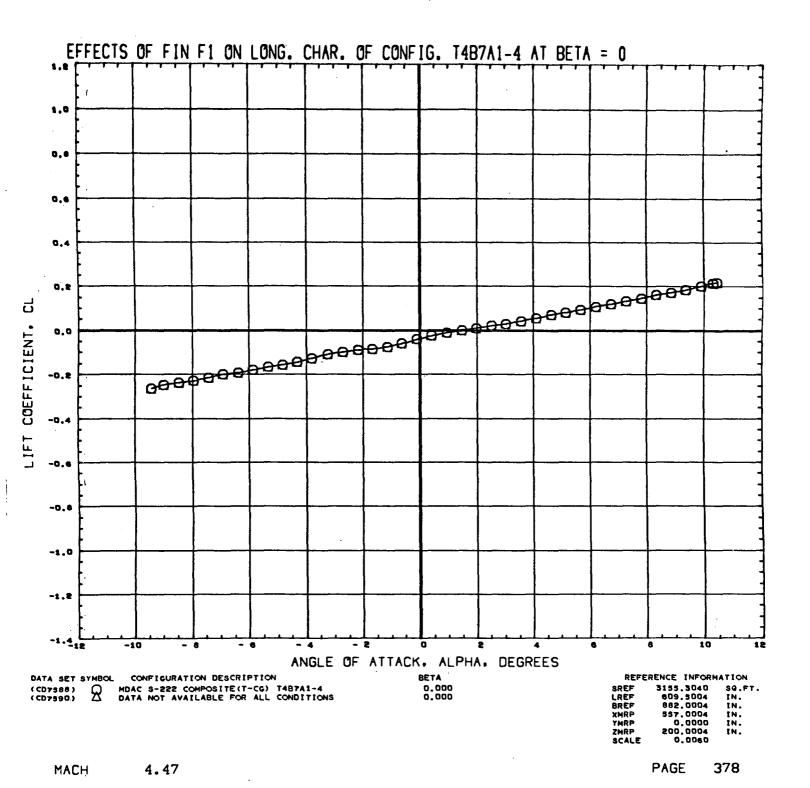


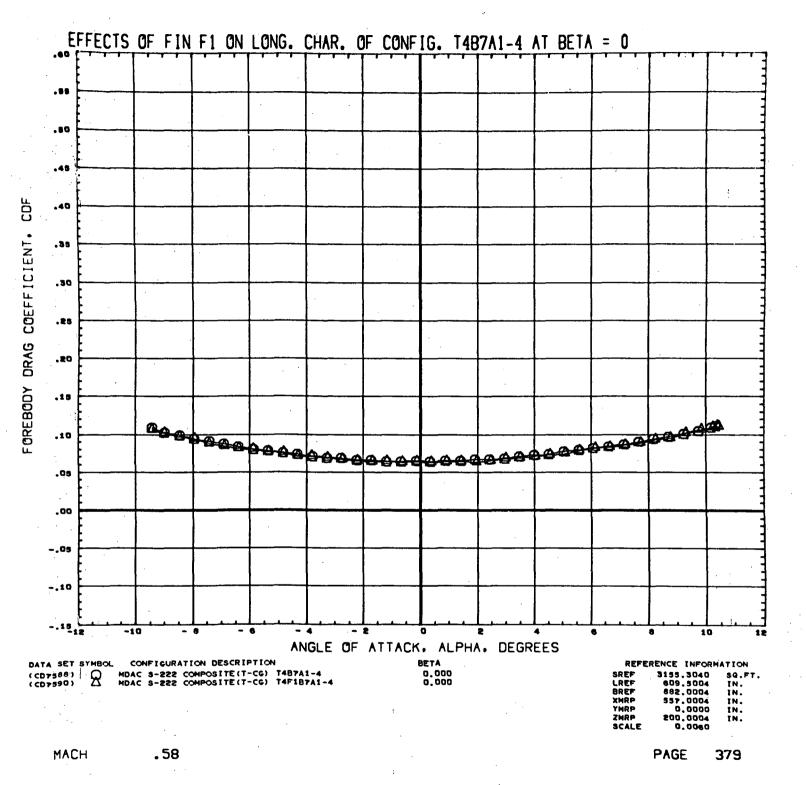


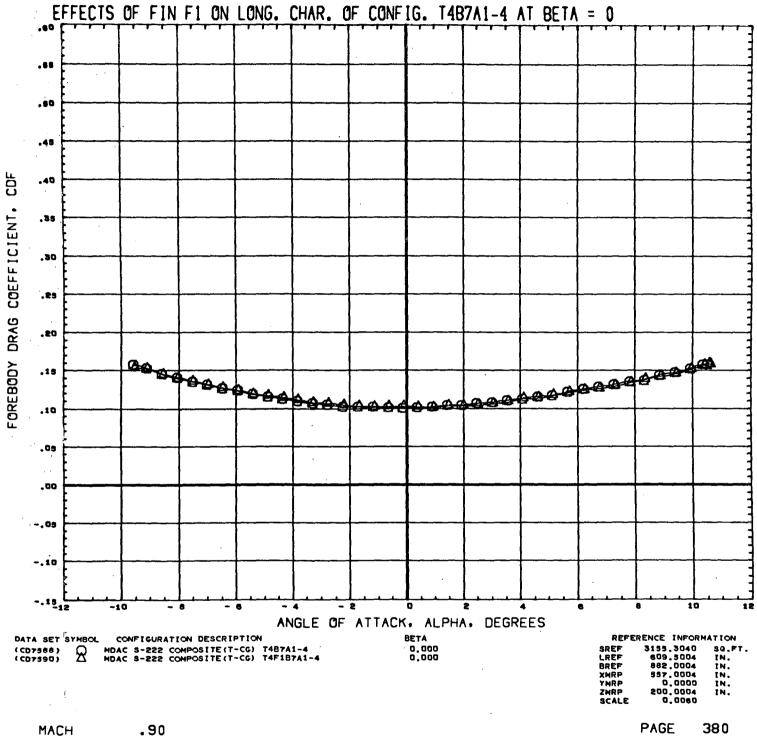
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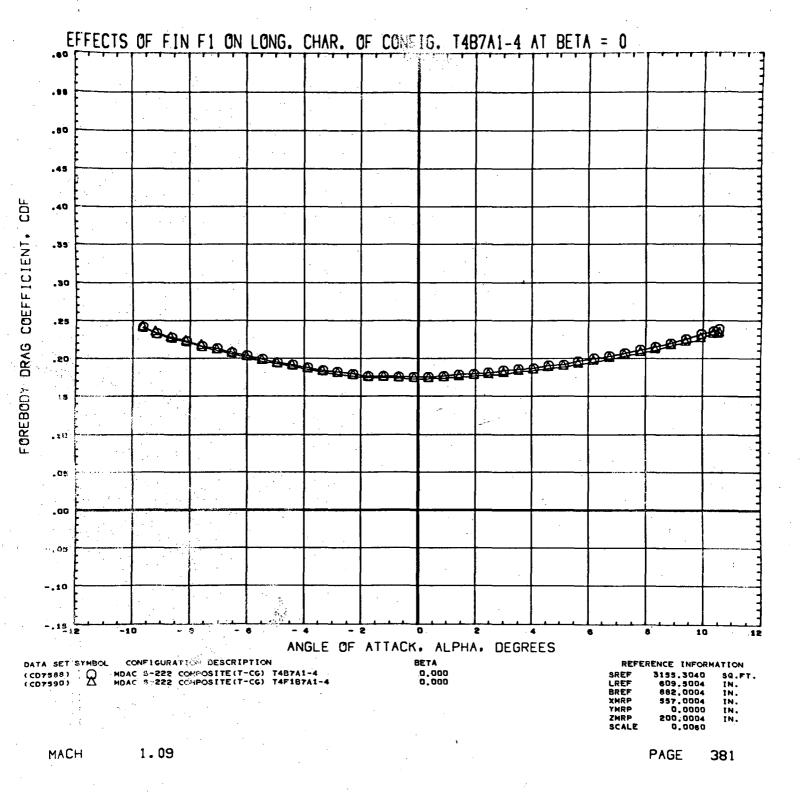
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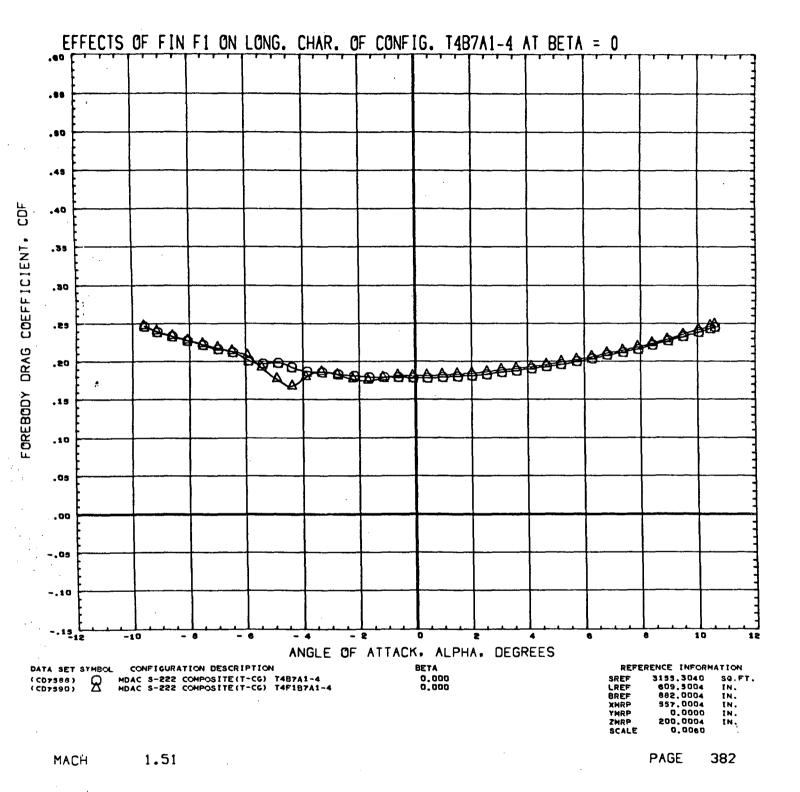
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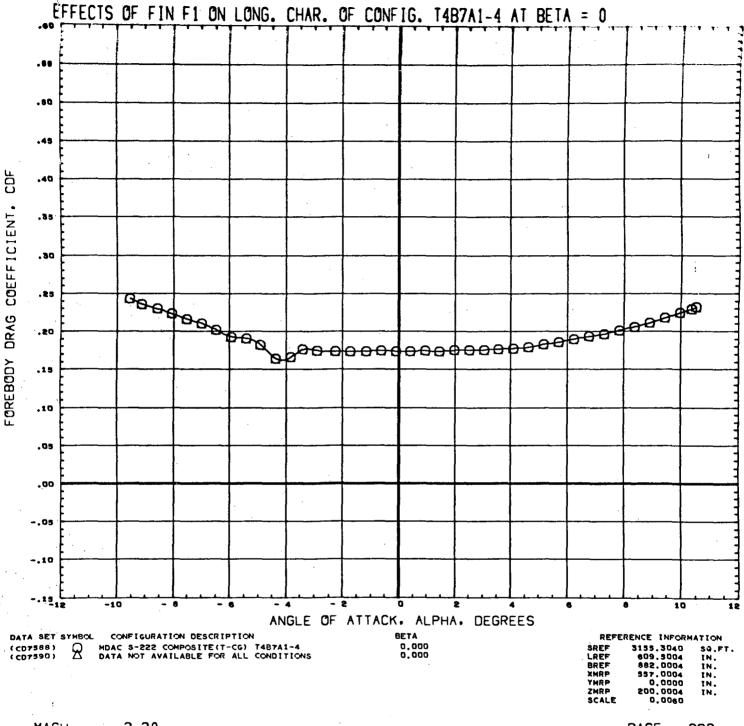




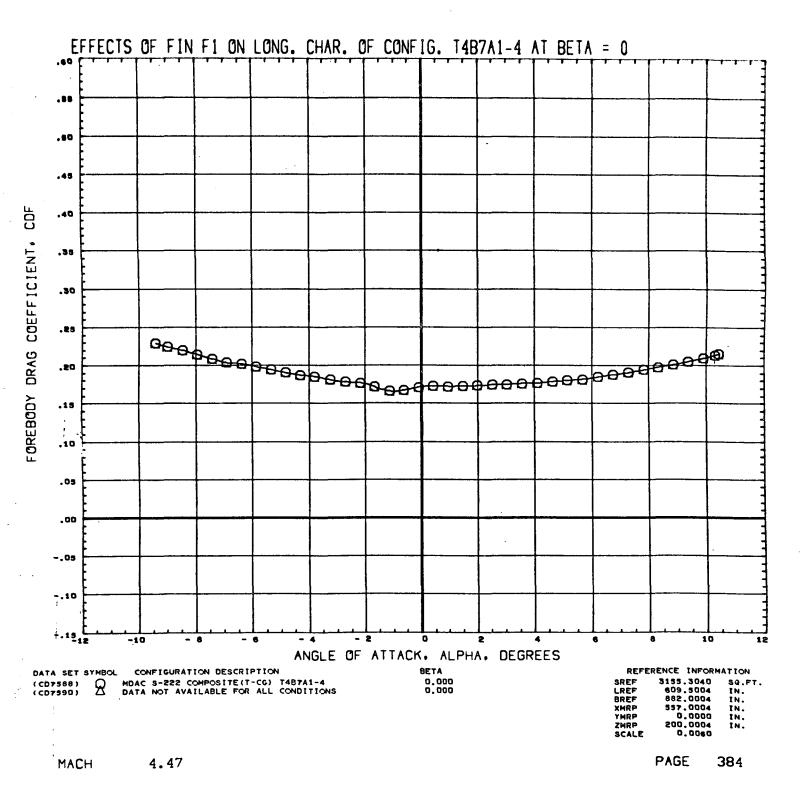


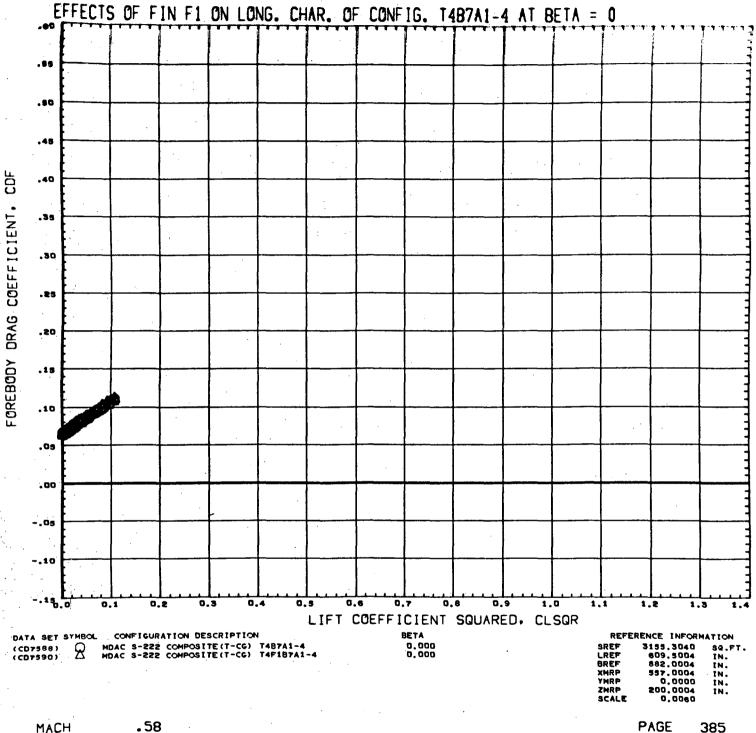






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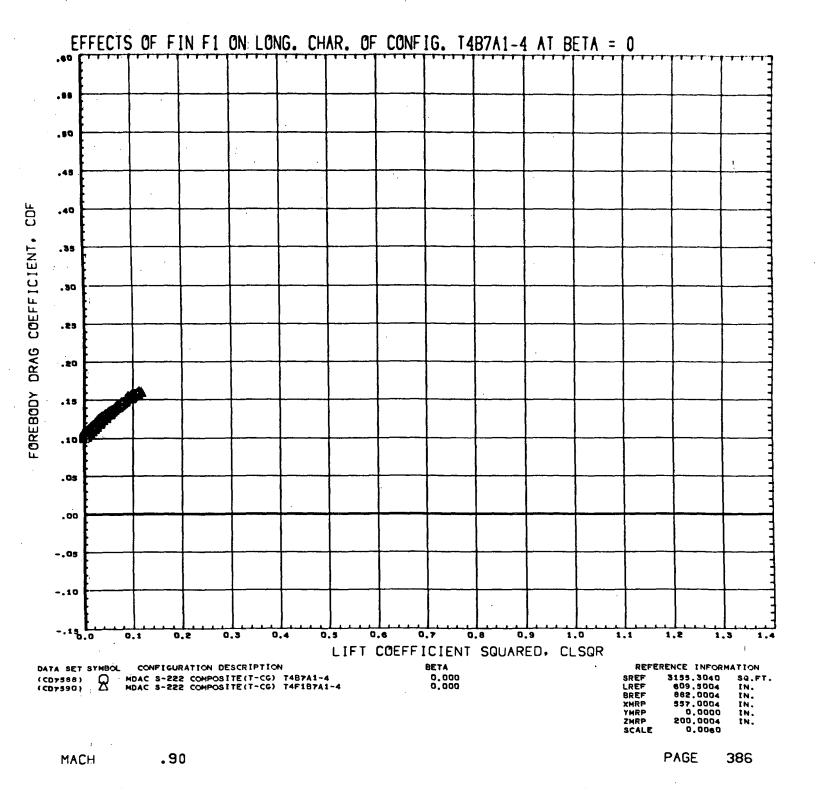


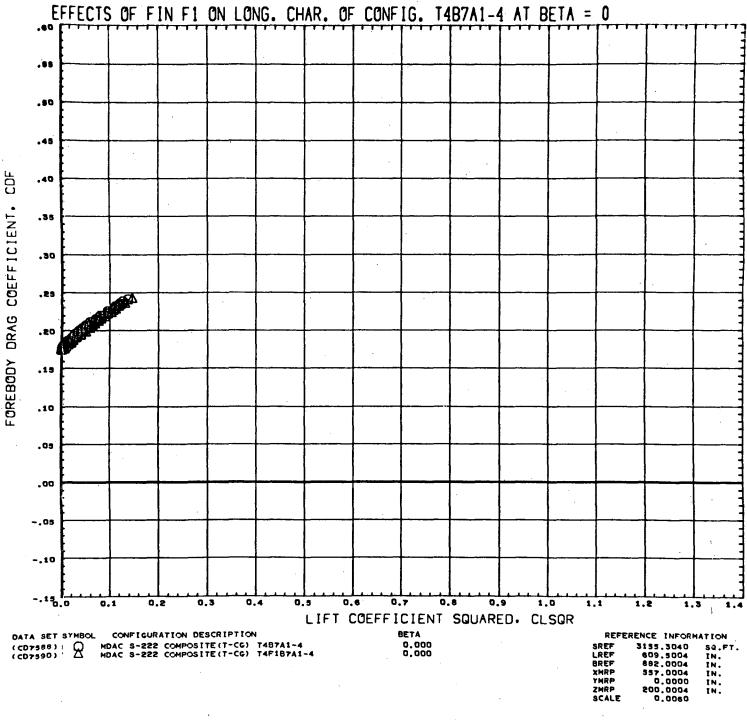


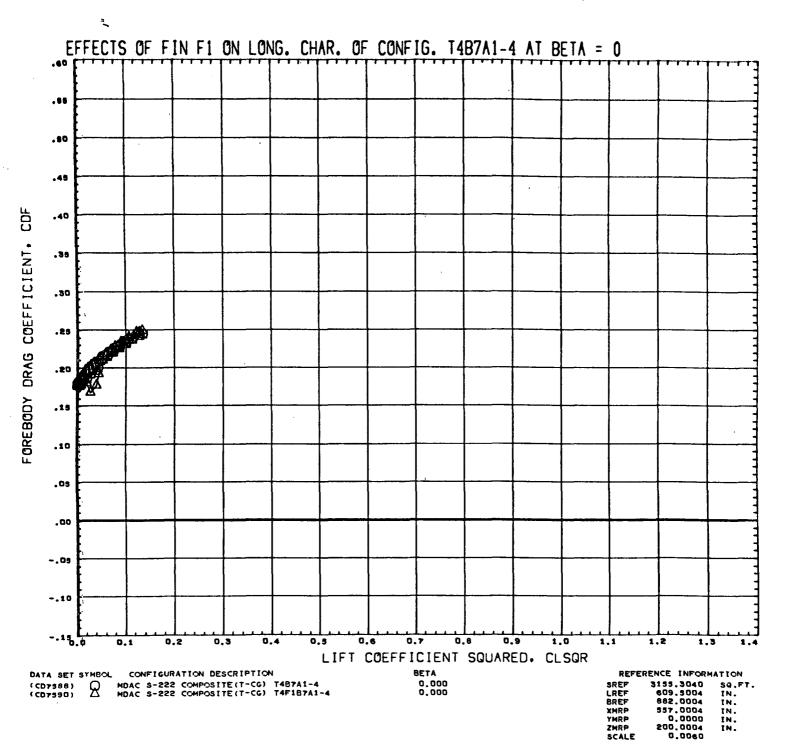
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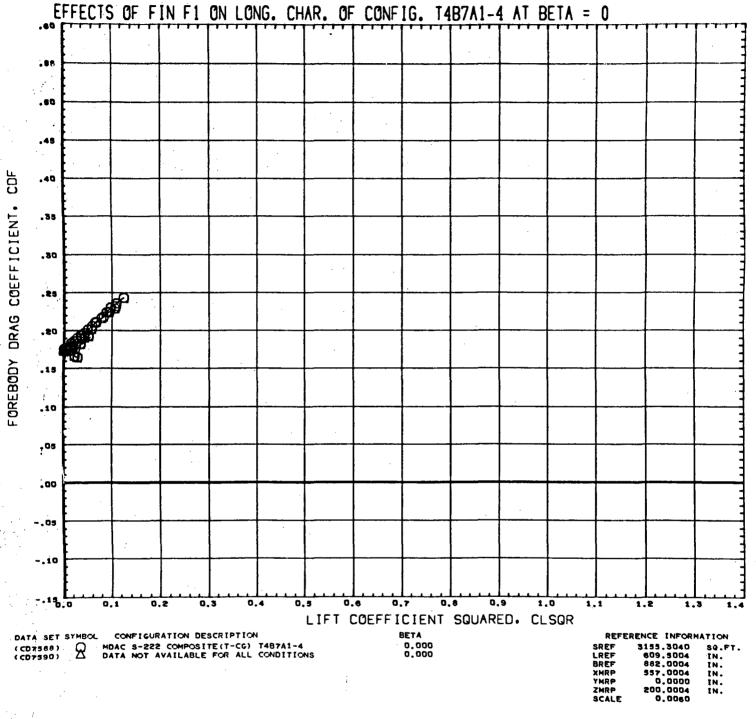
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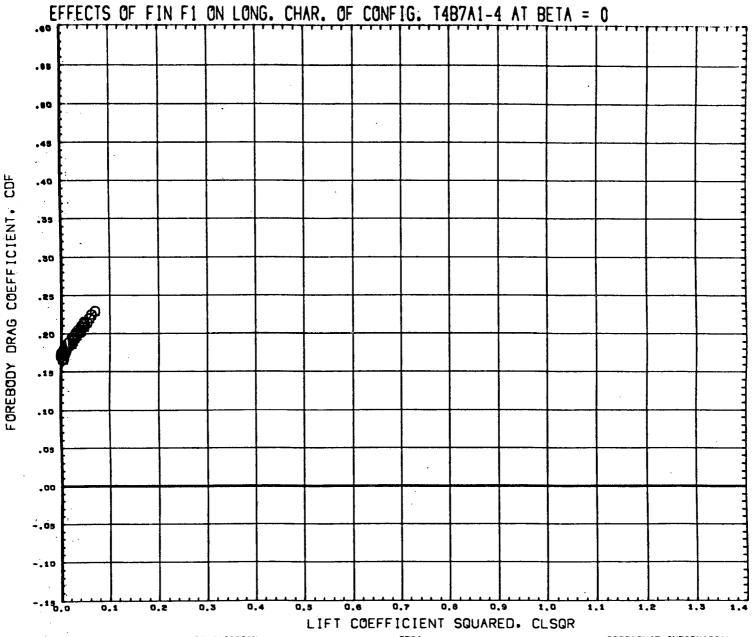






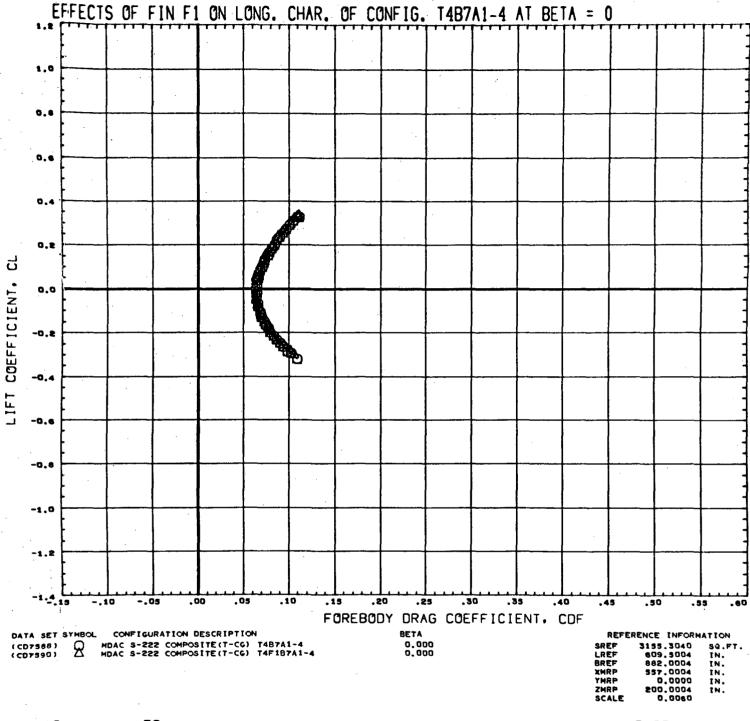


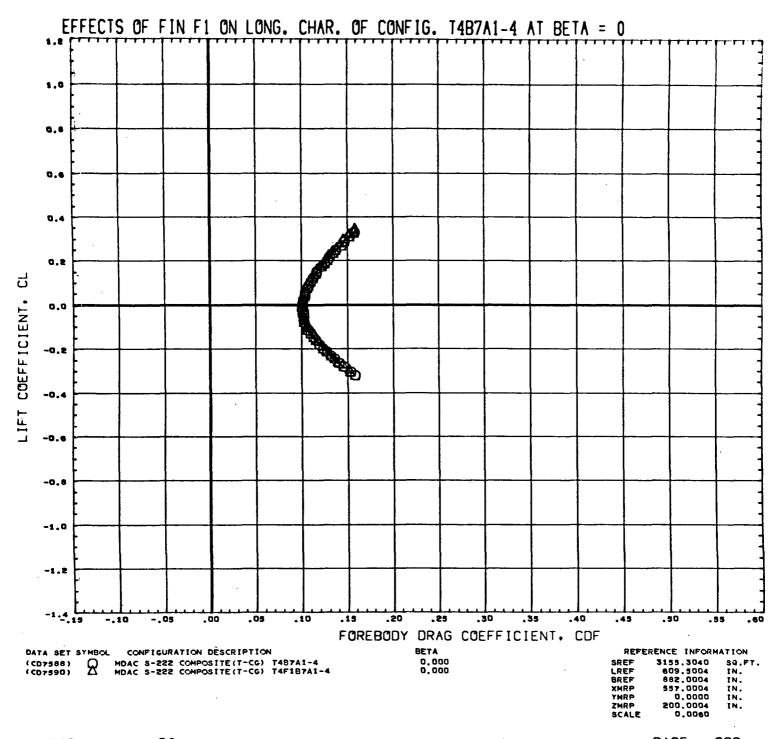
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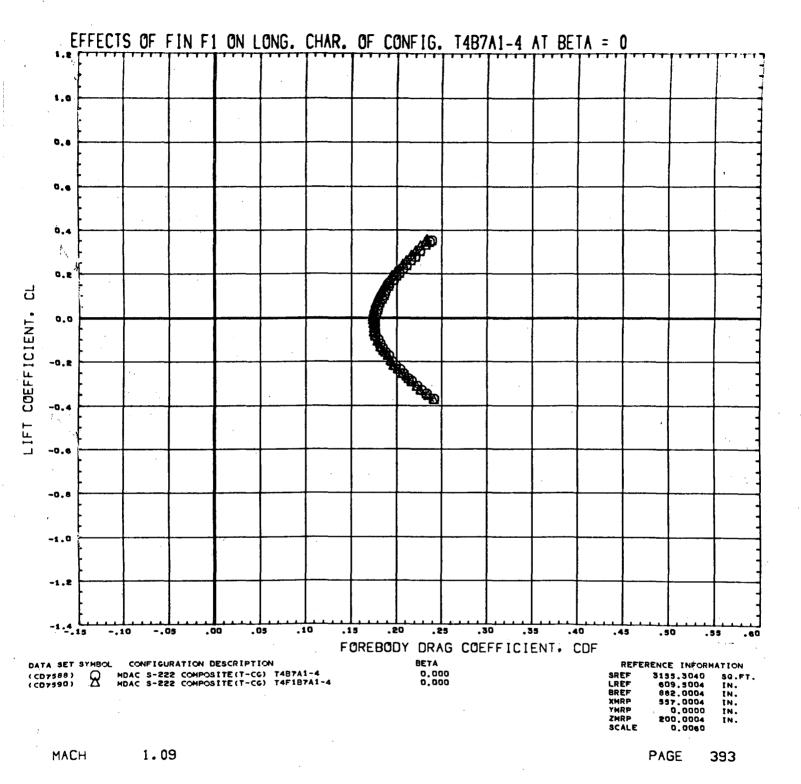


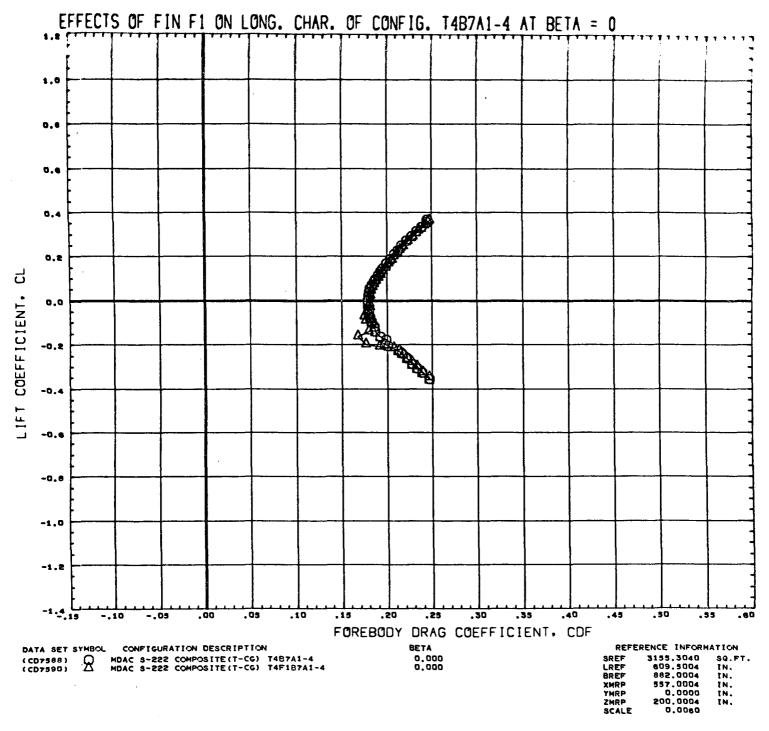
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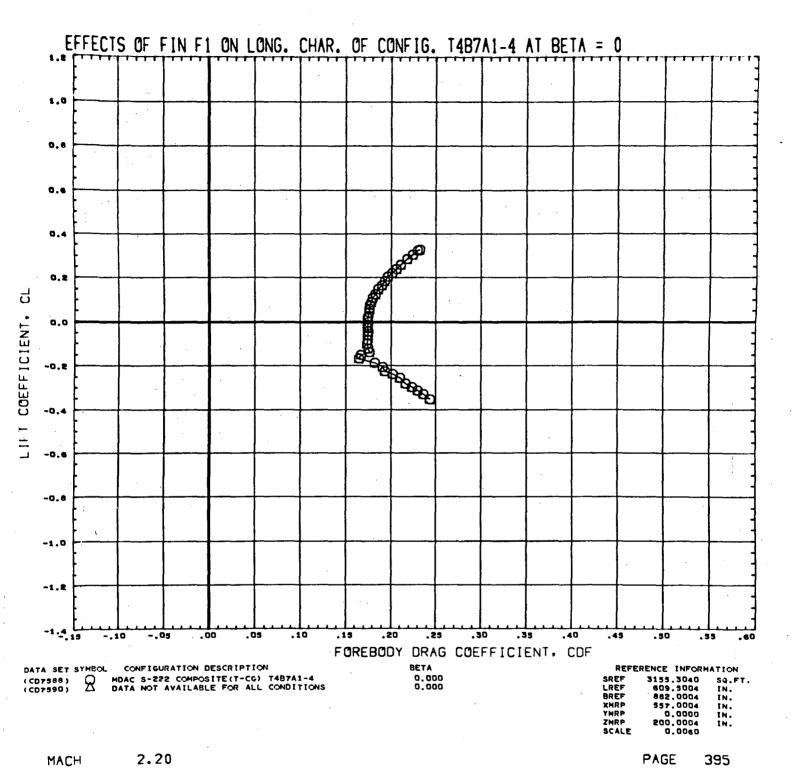


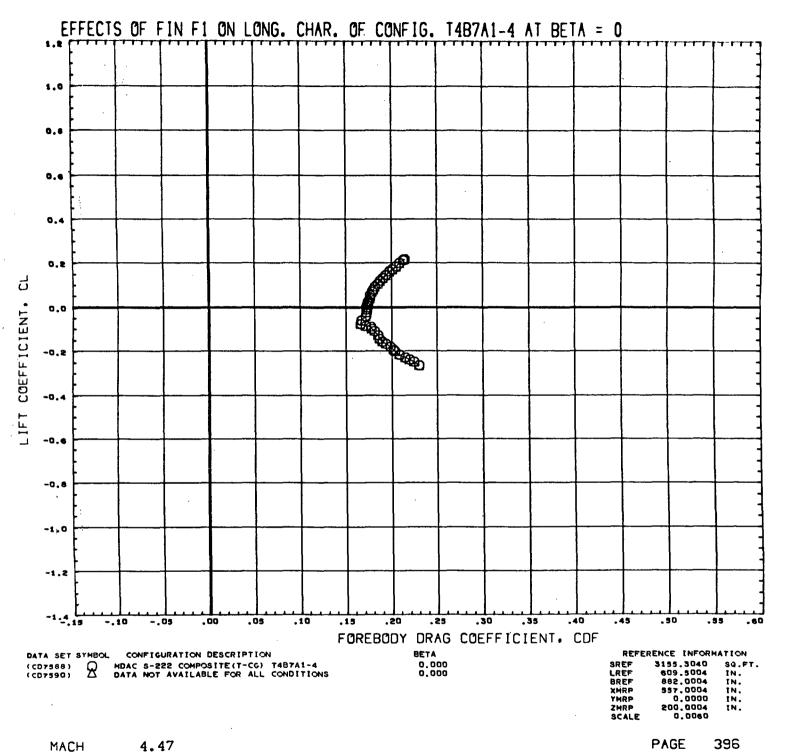


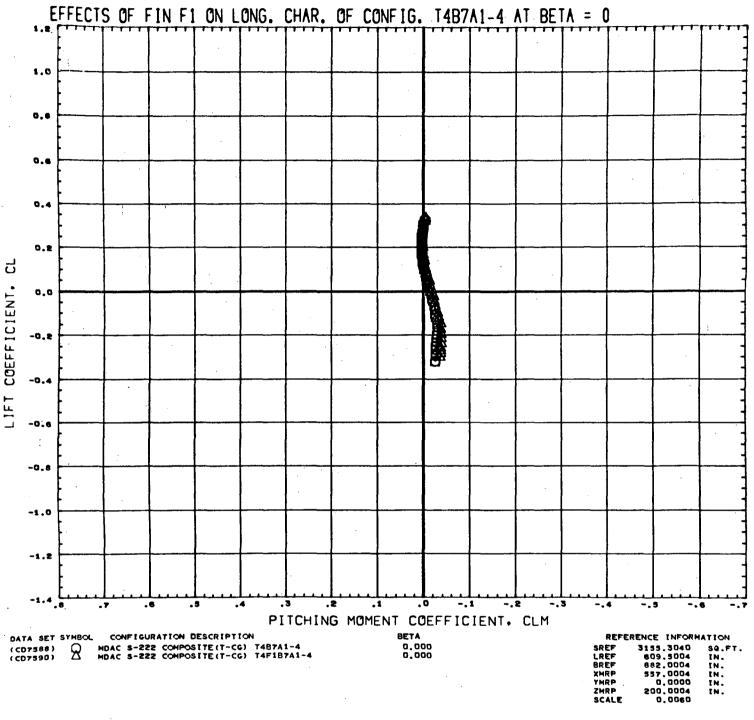




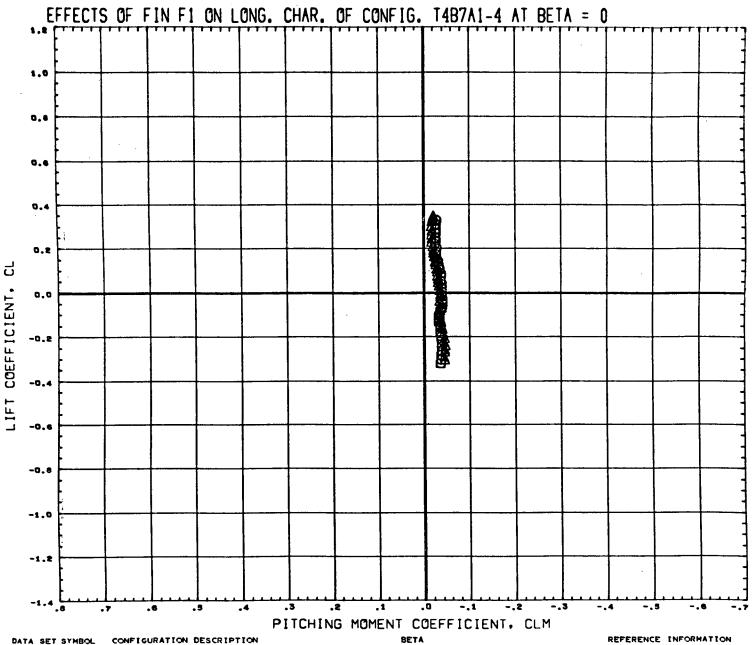
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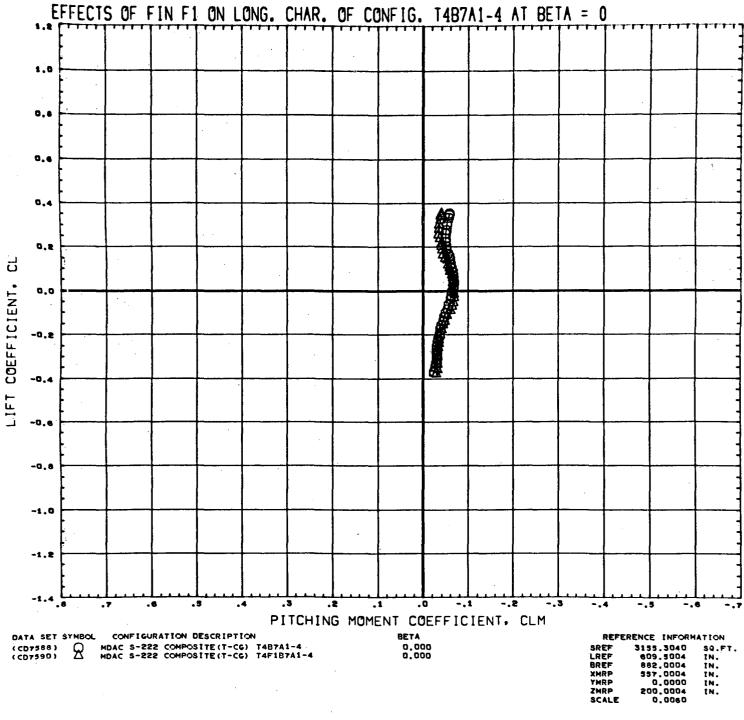
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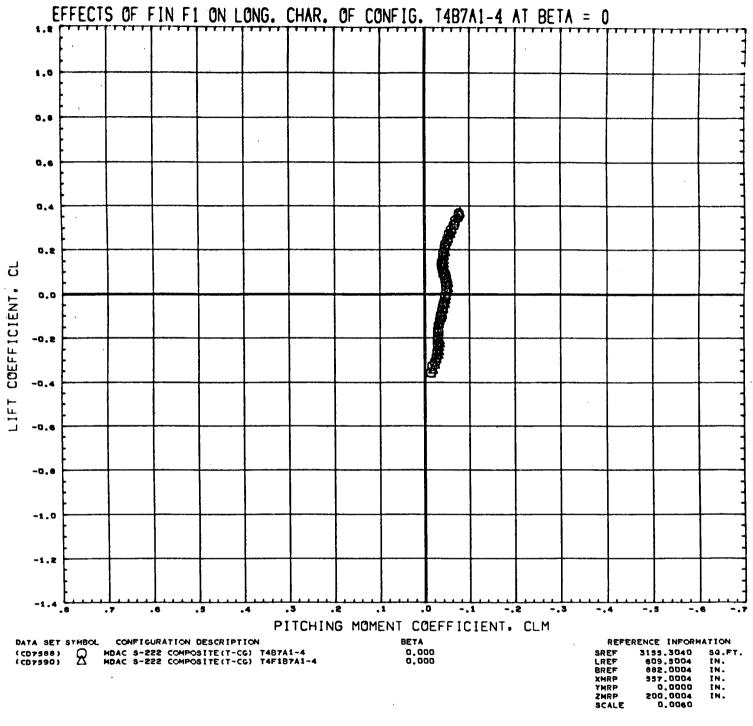
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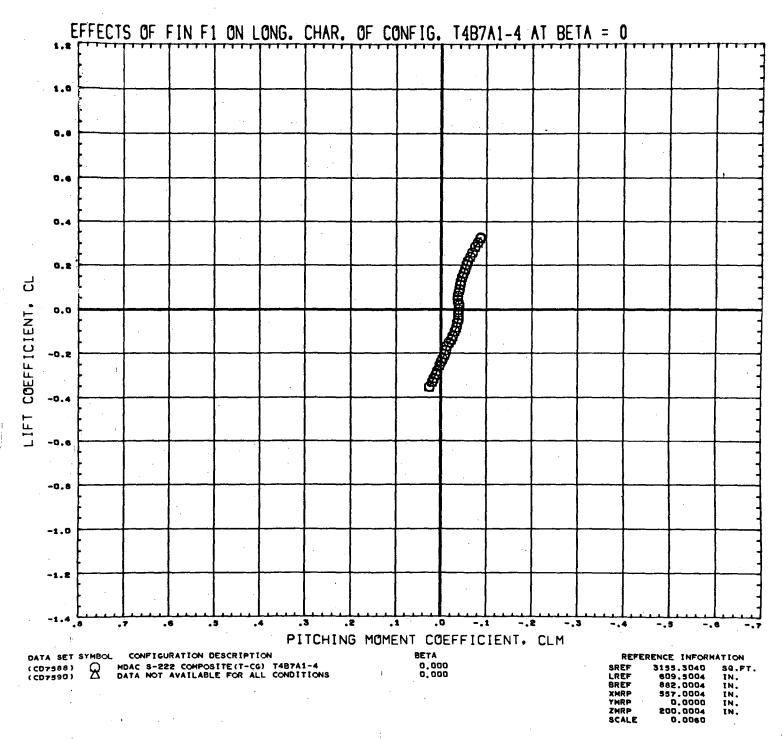


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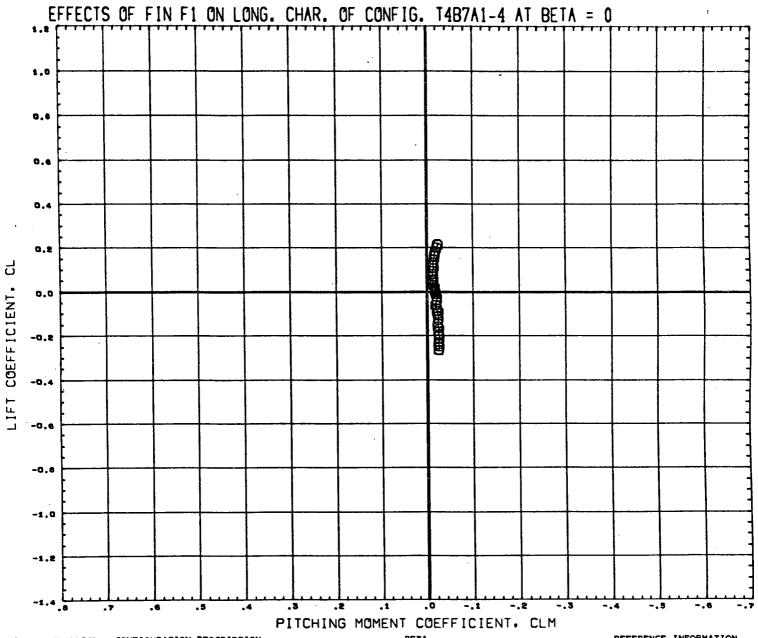


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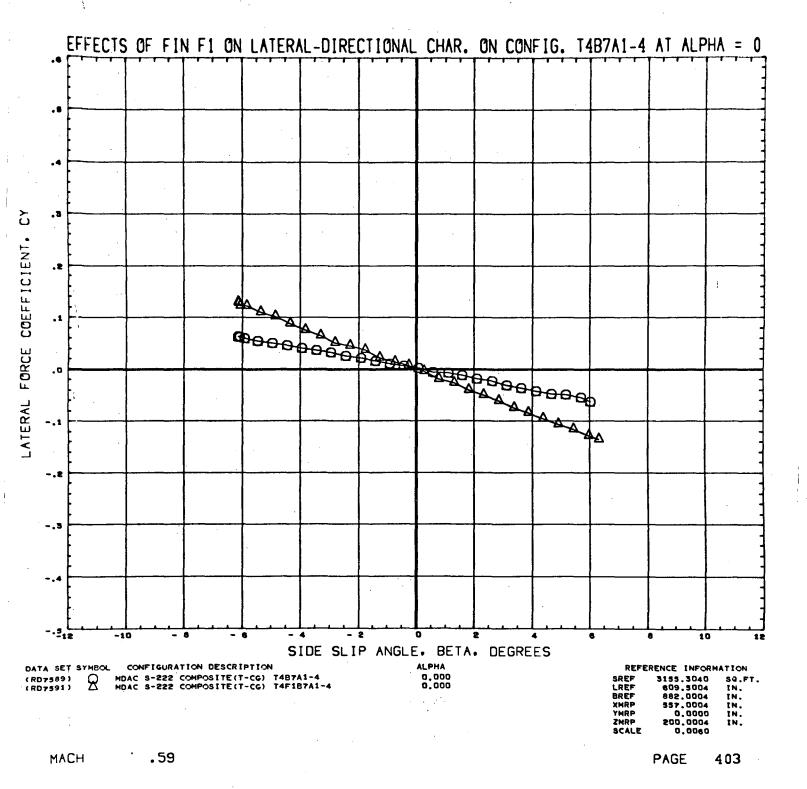


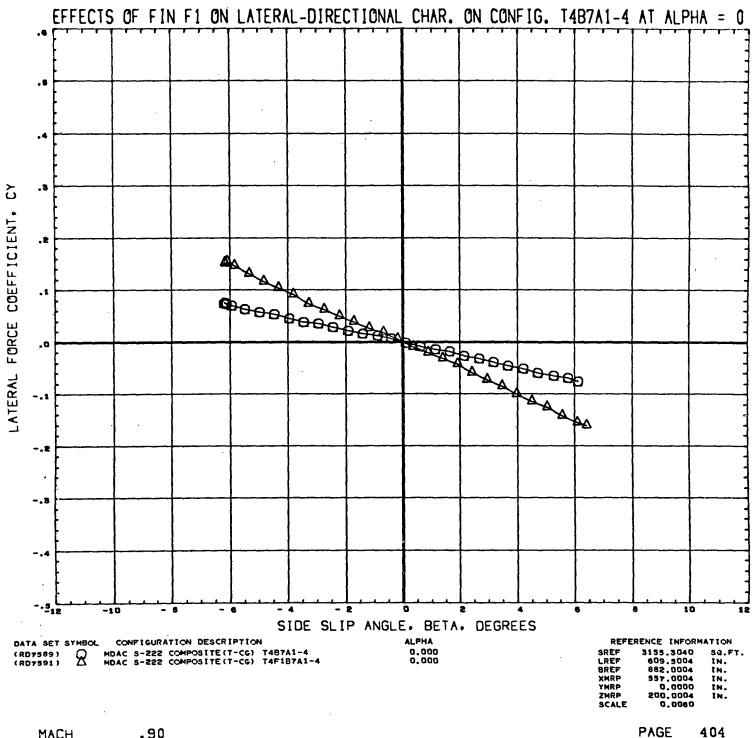
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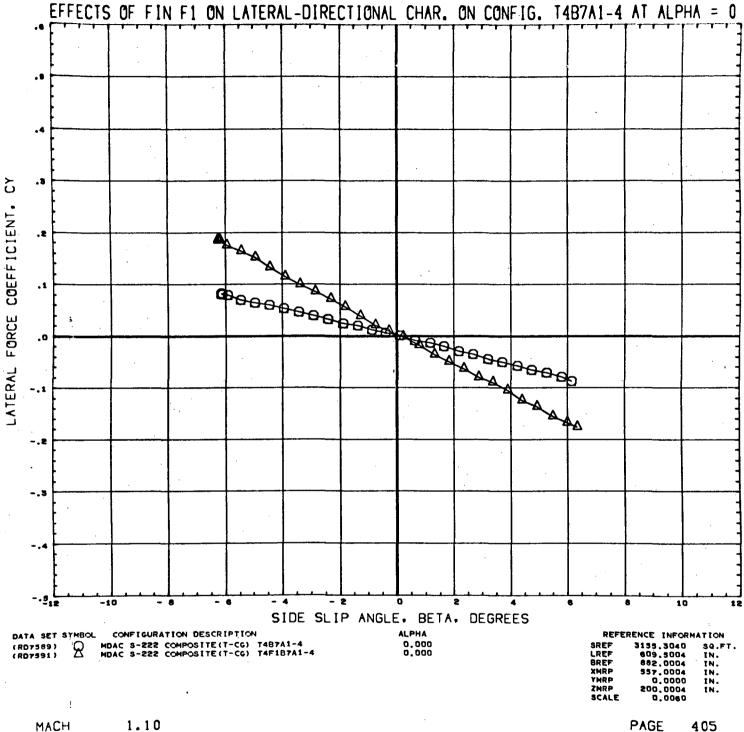
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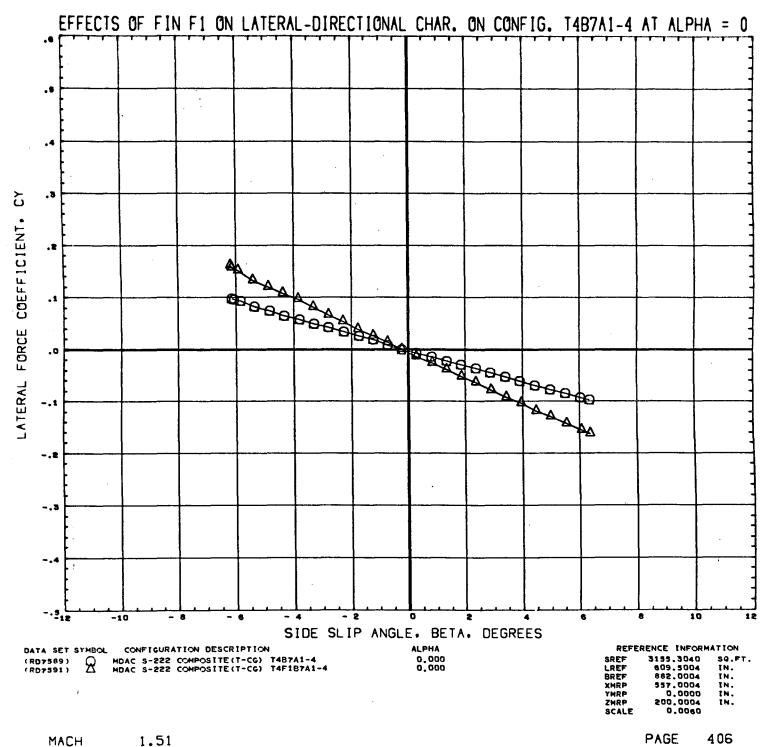


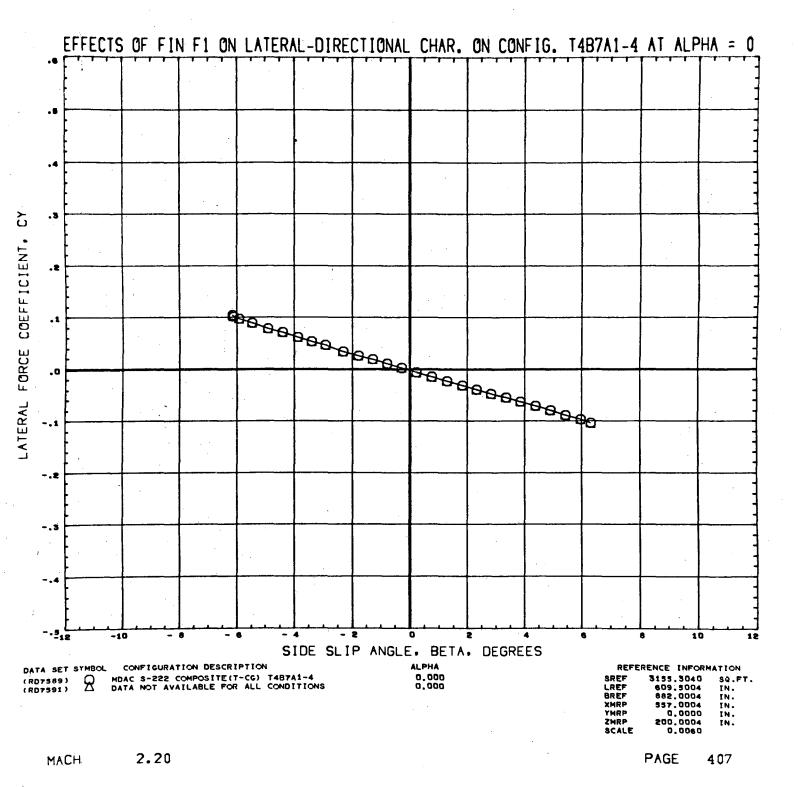


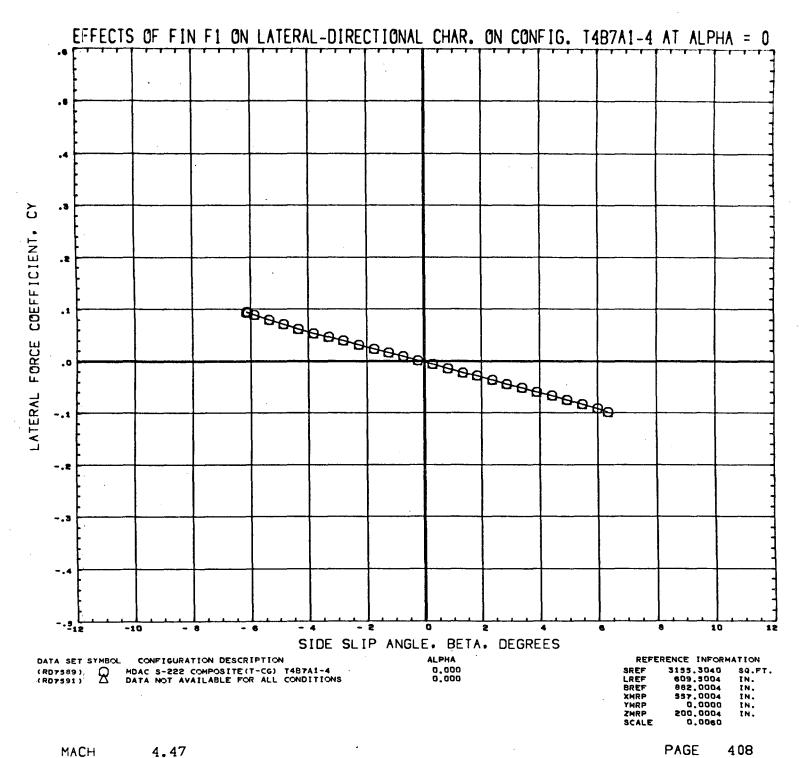
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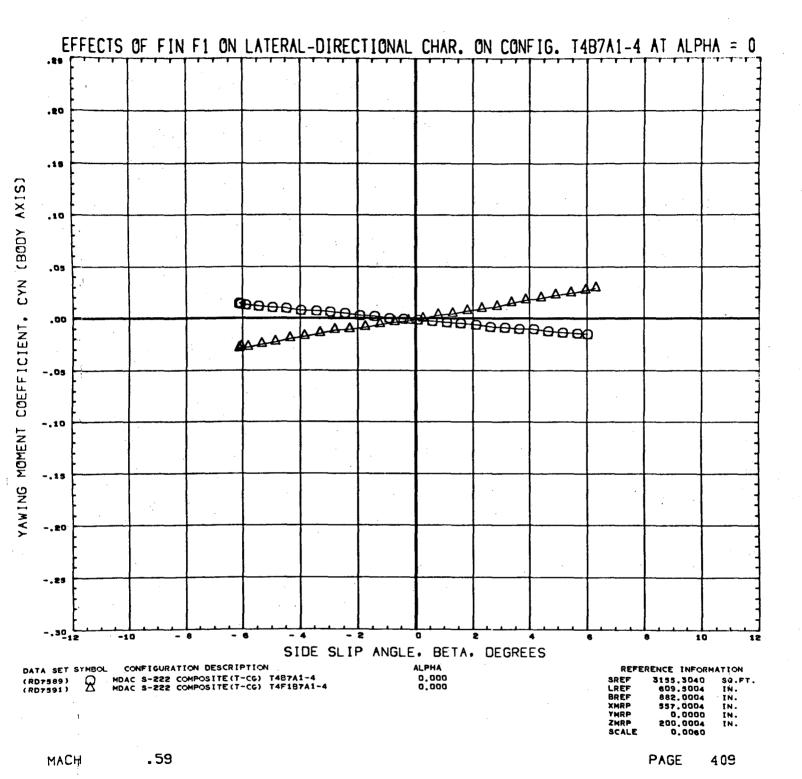


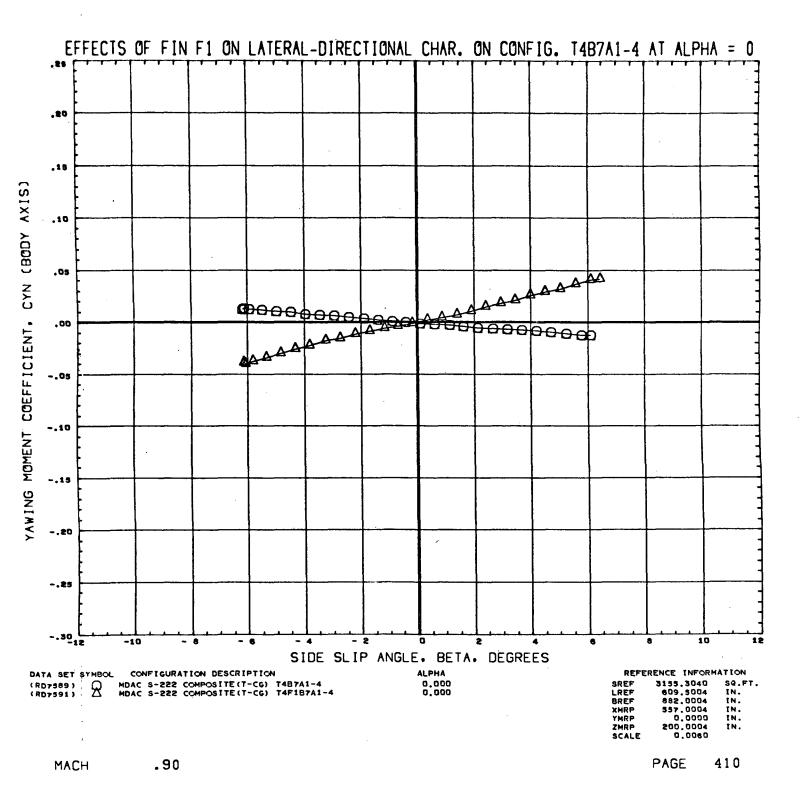
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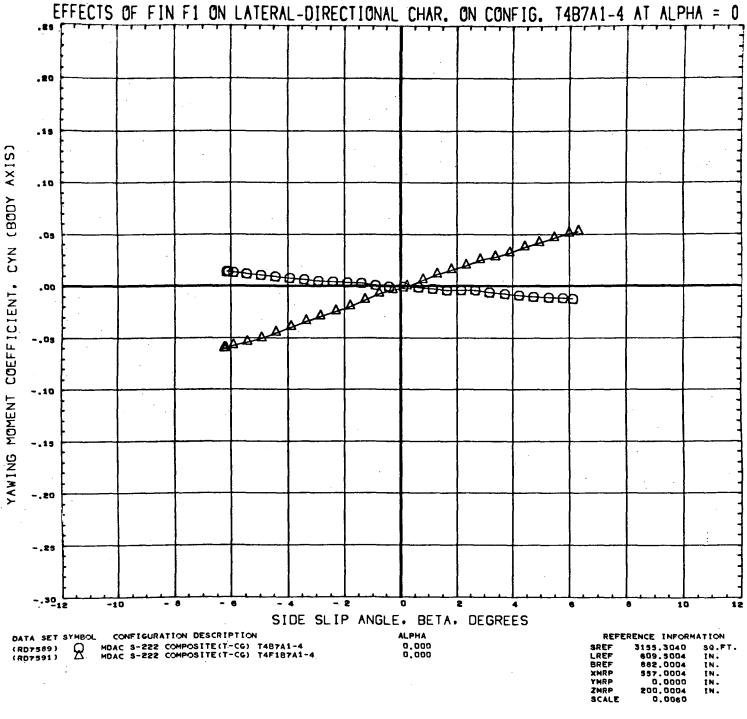




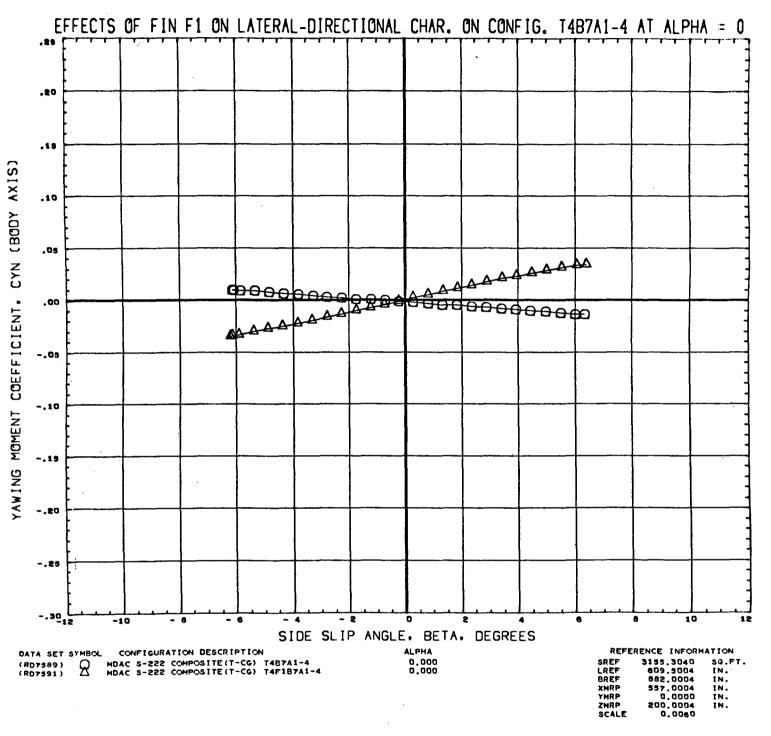




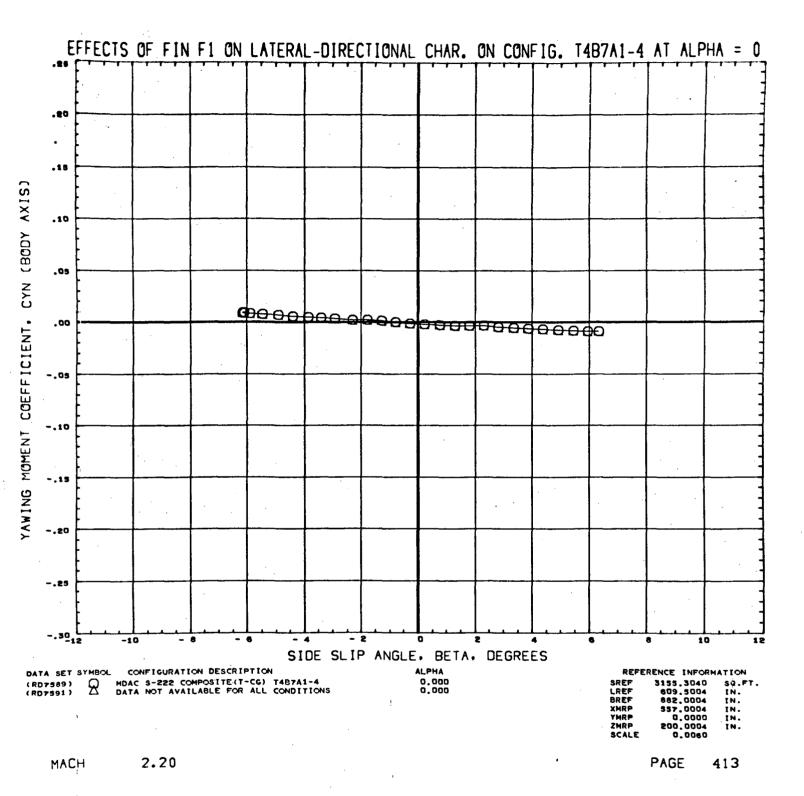


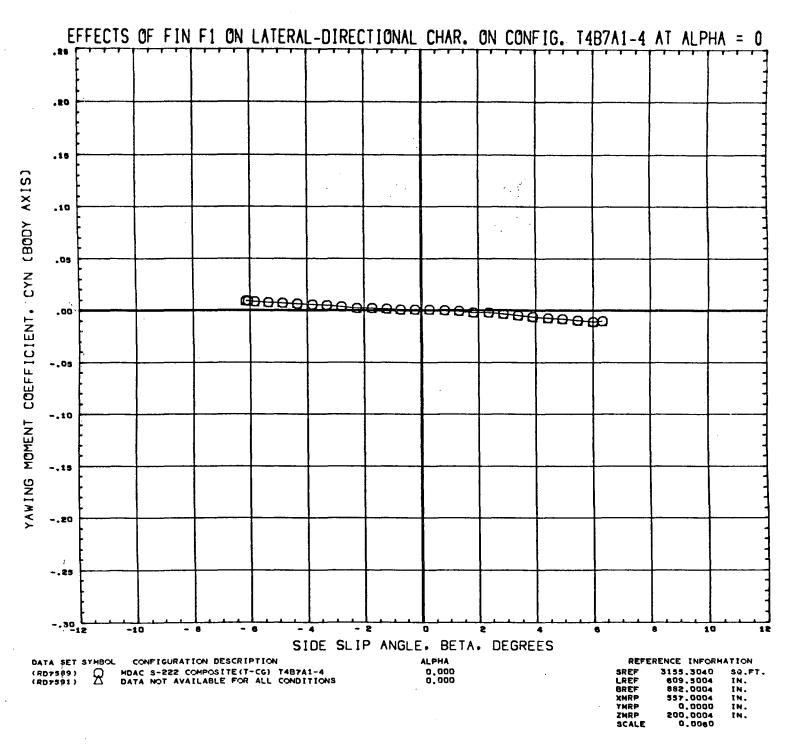


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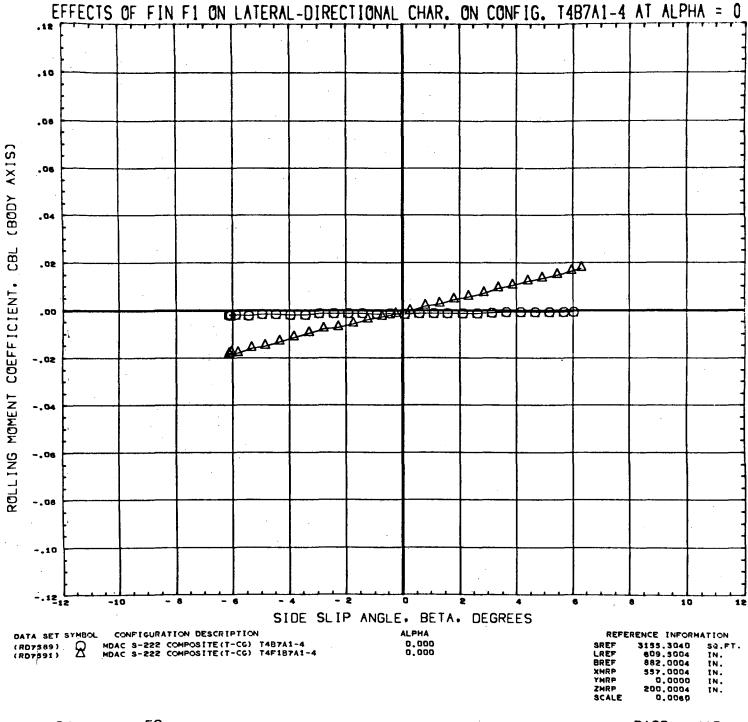


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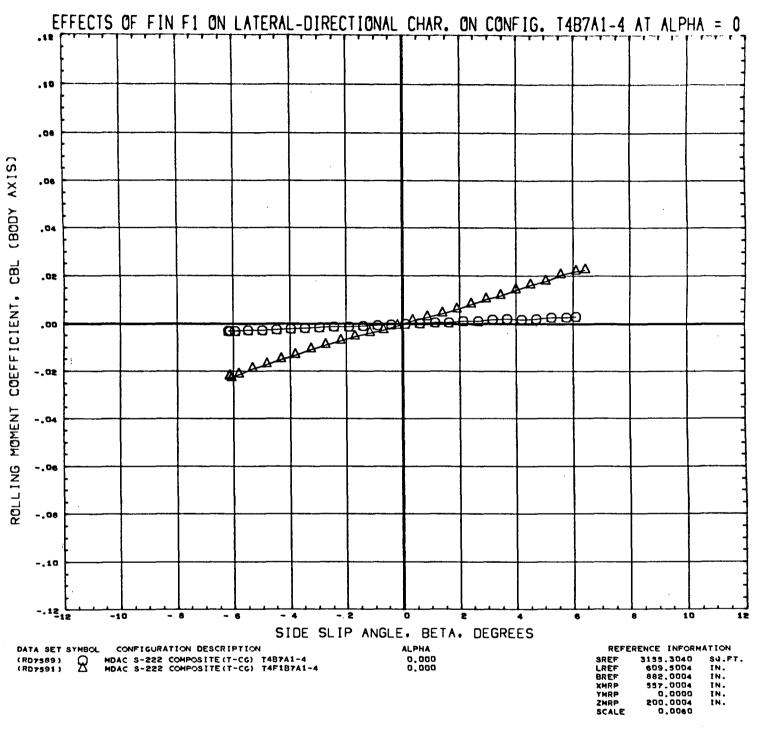




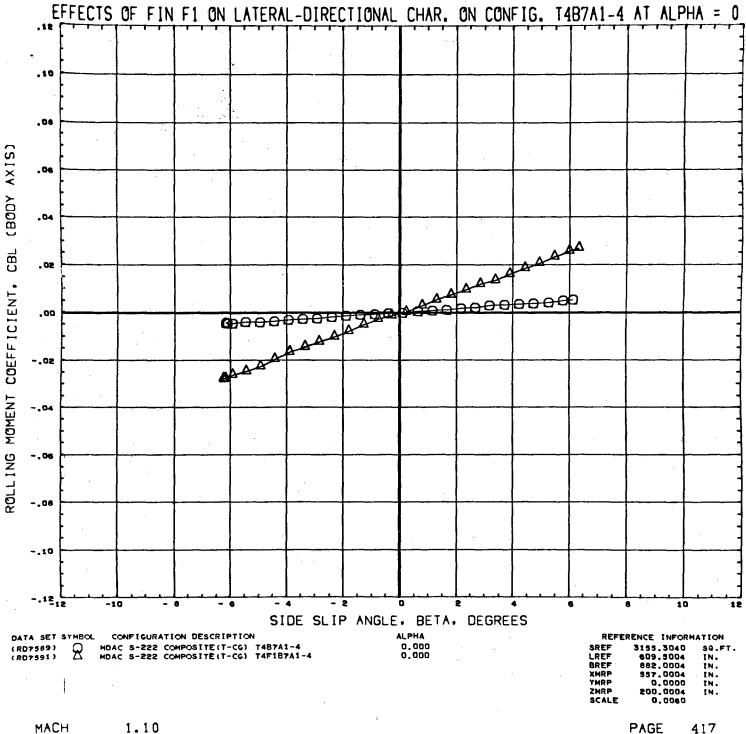
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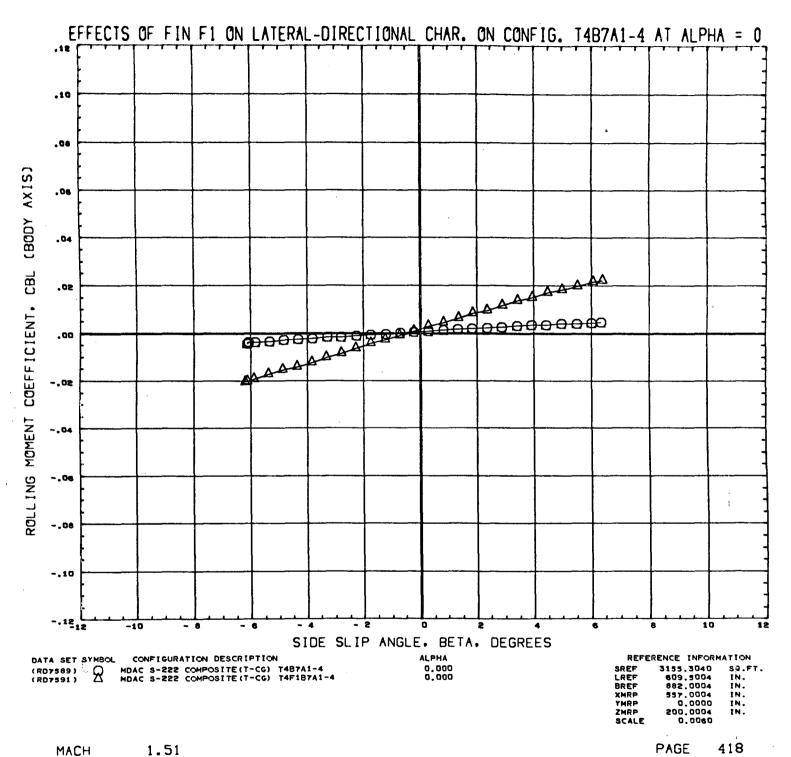
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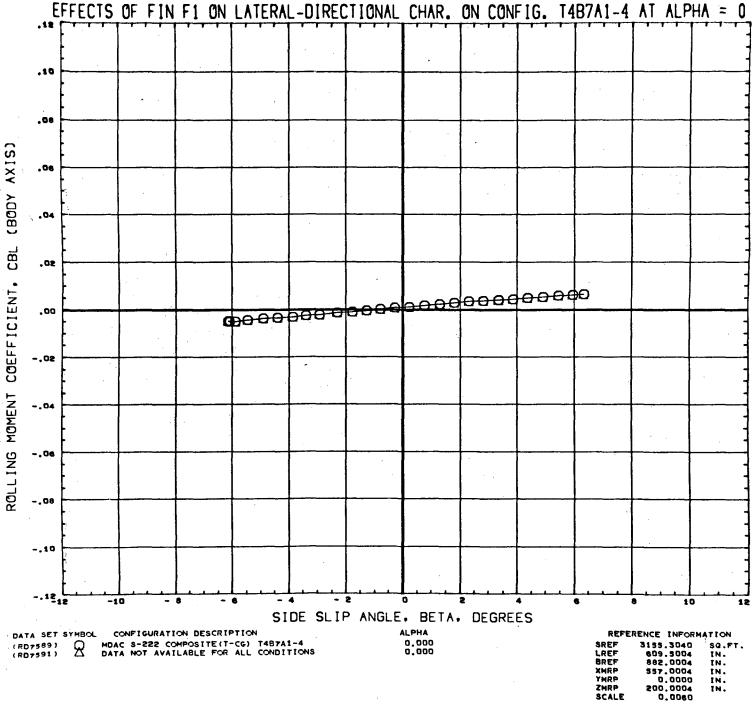


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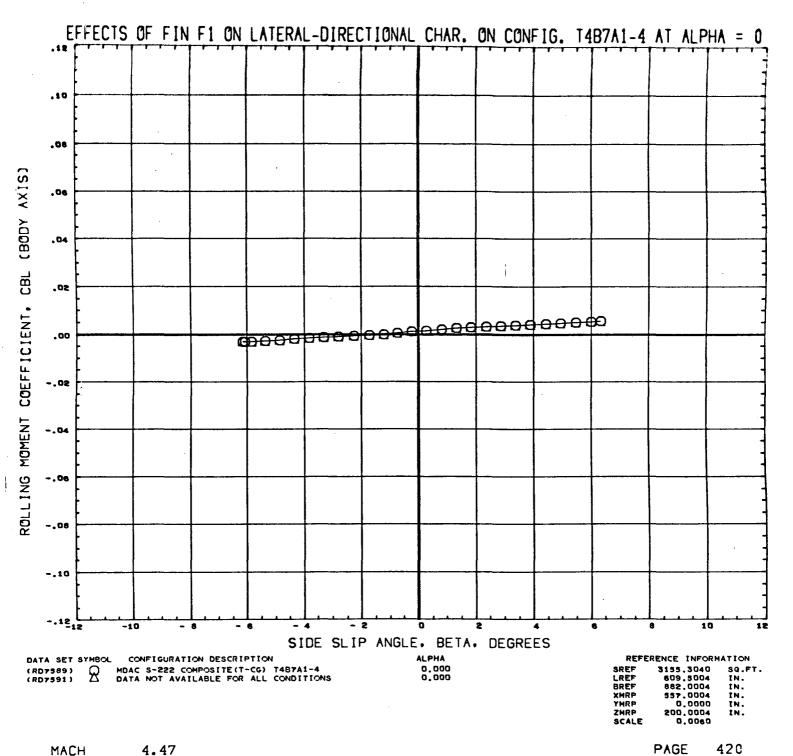


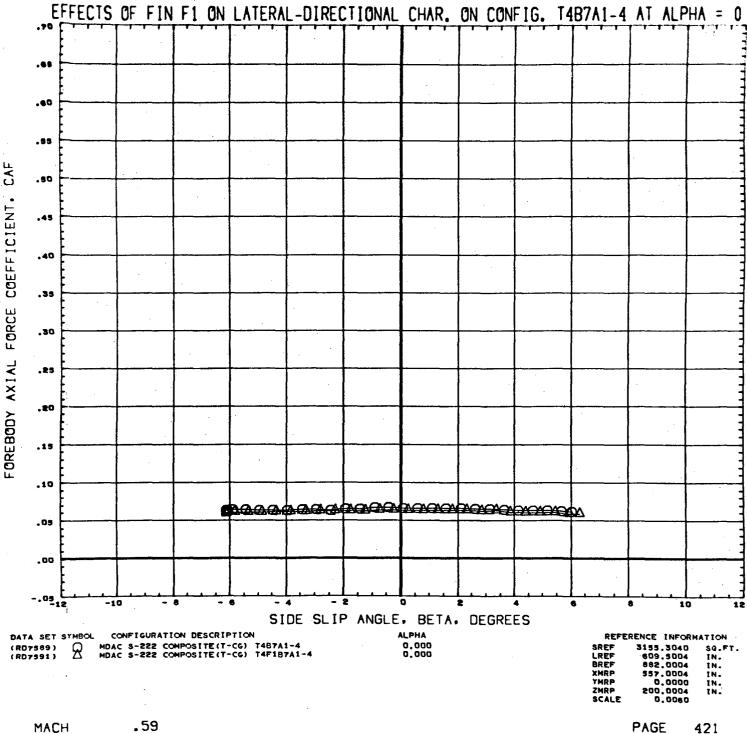
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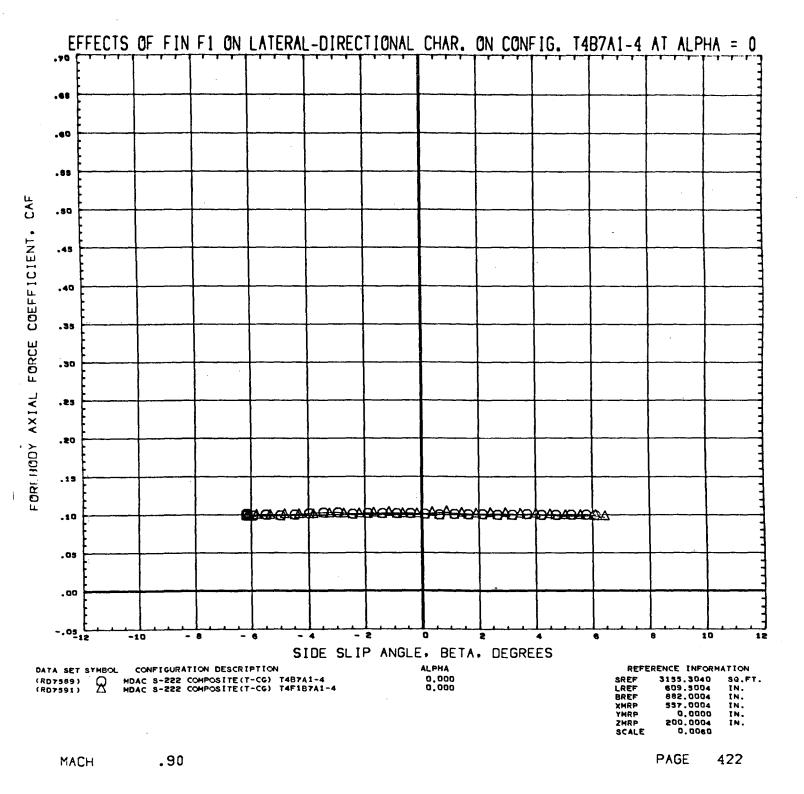


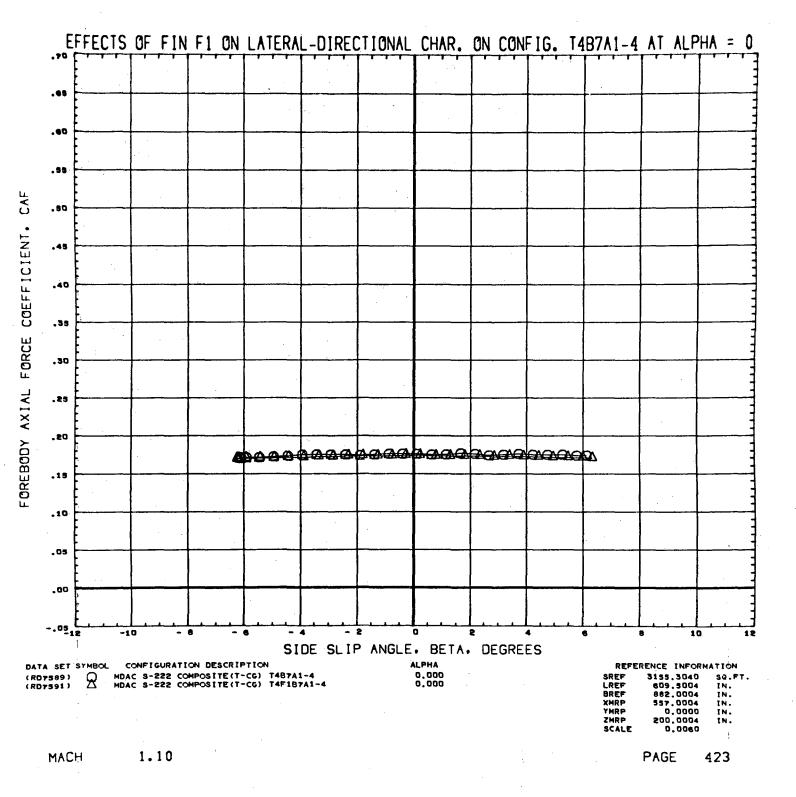


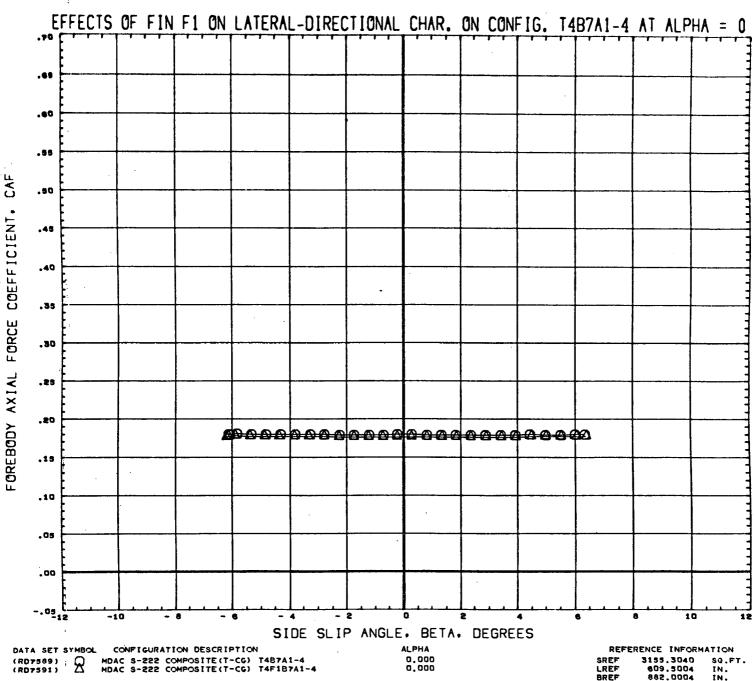
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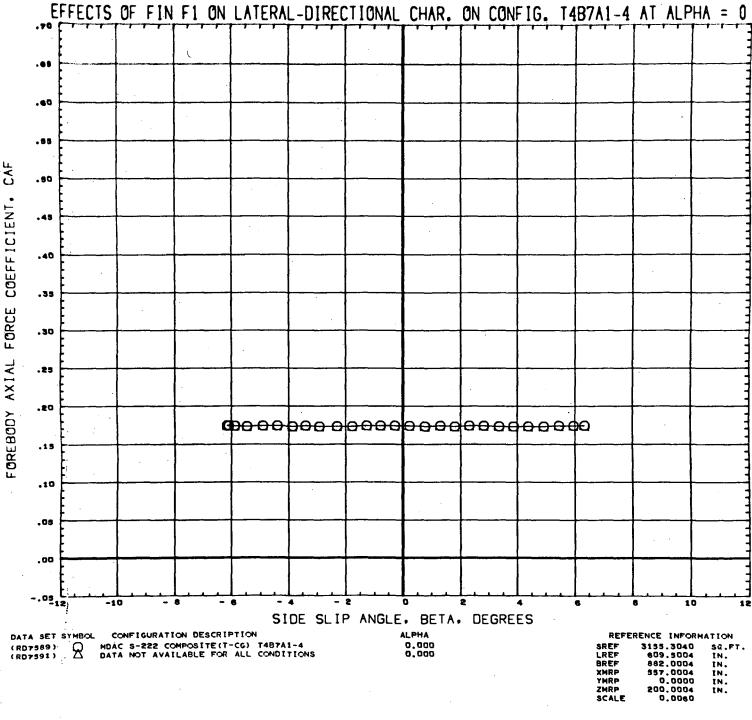






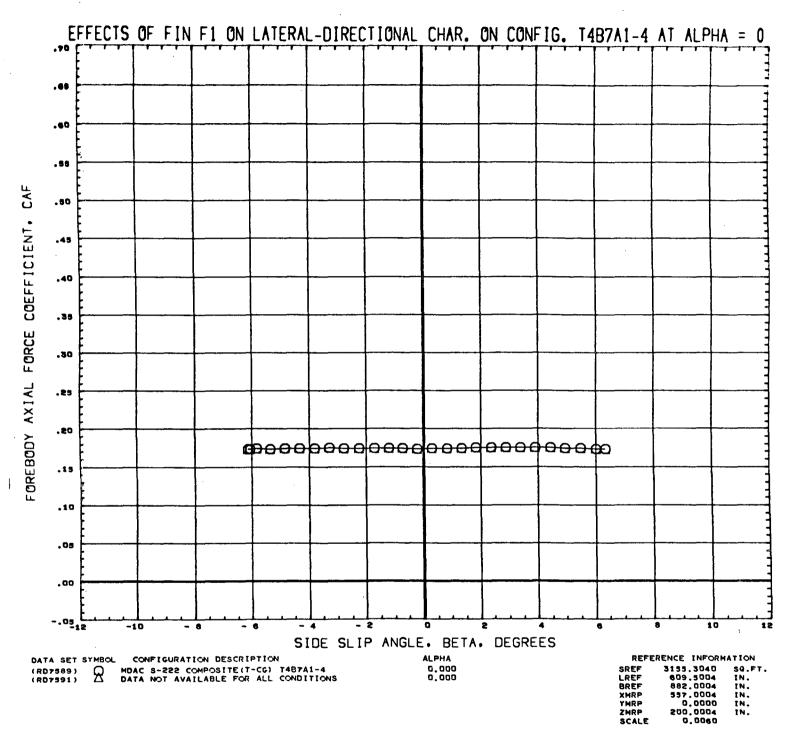
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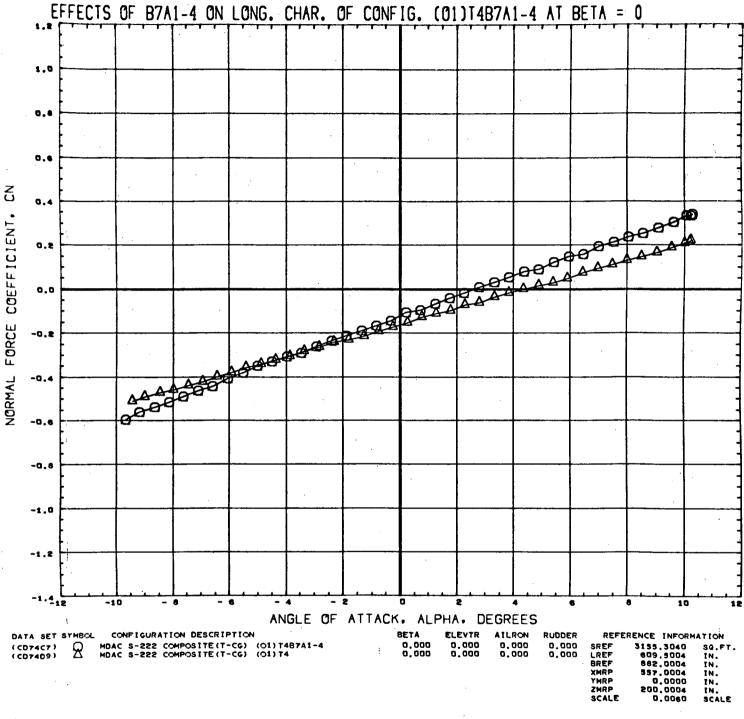
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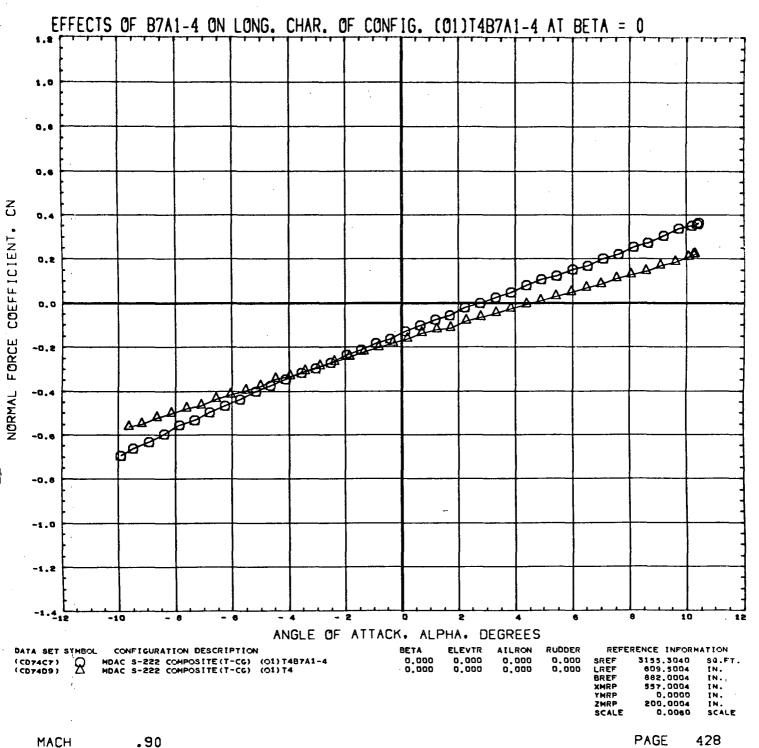


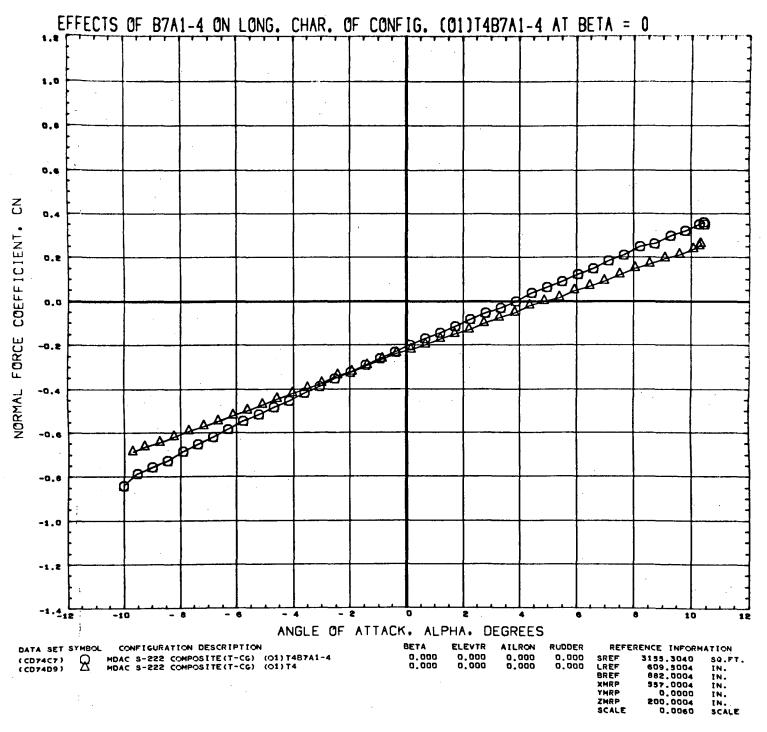
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MACH .58

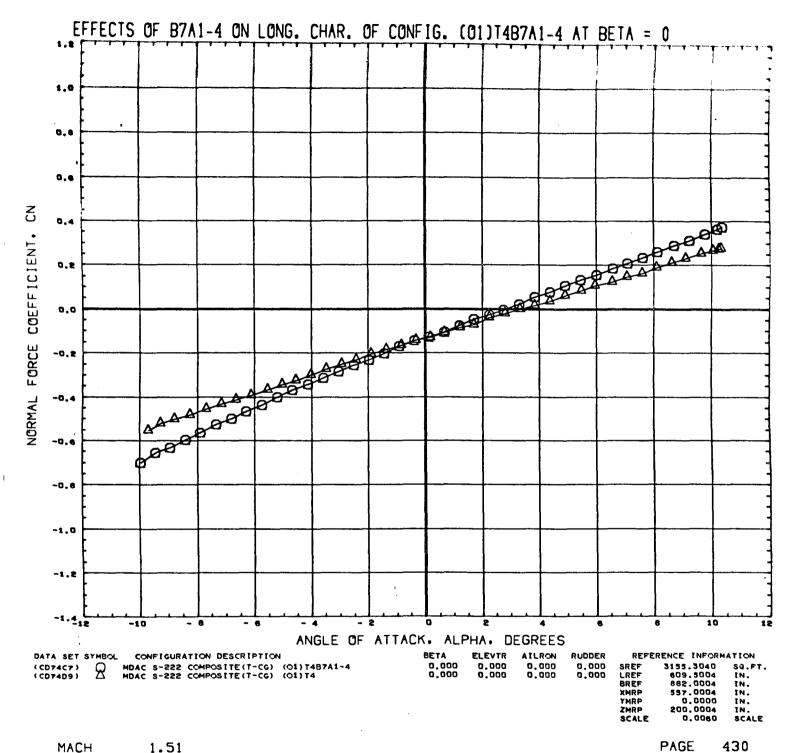


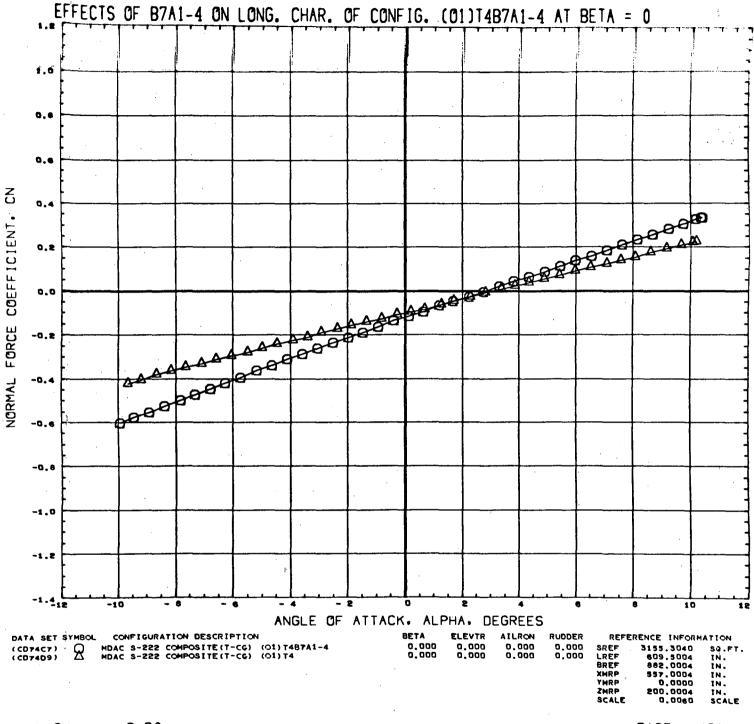


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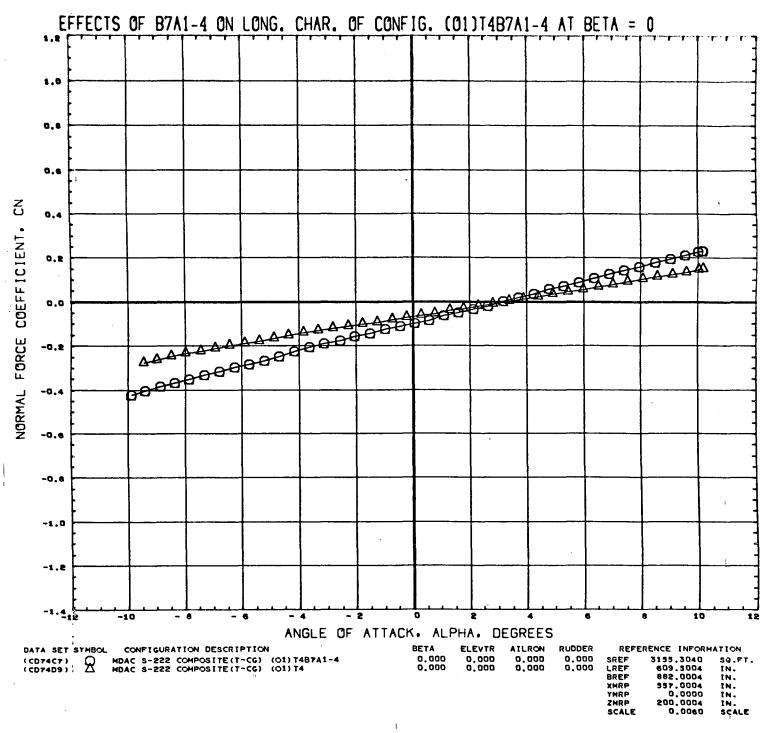
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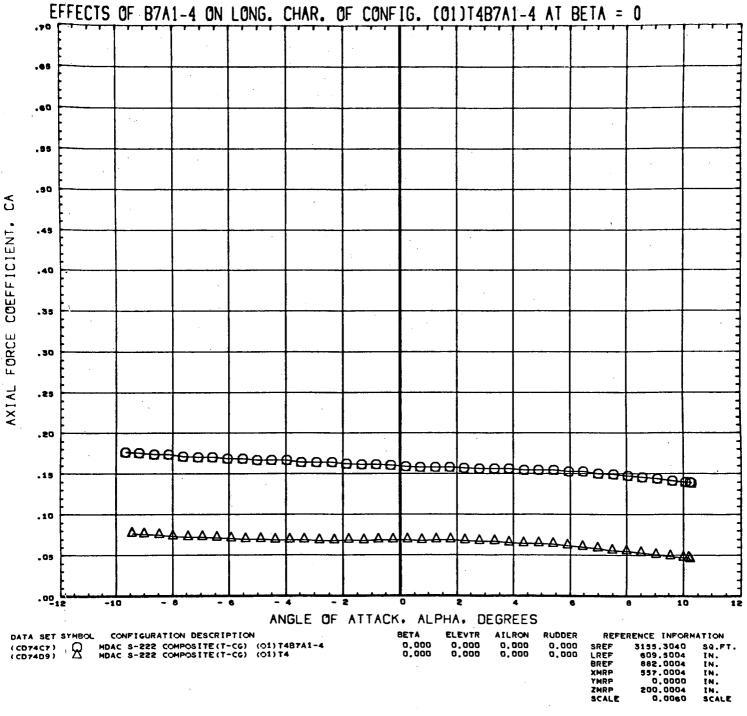


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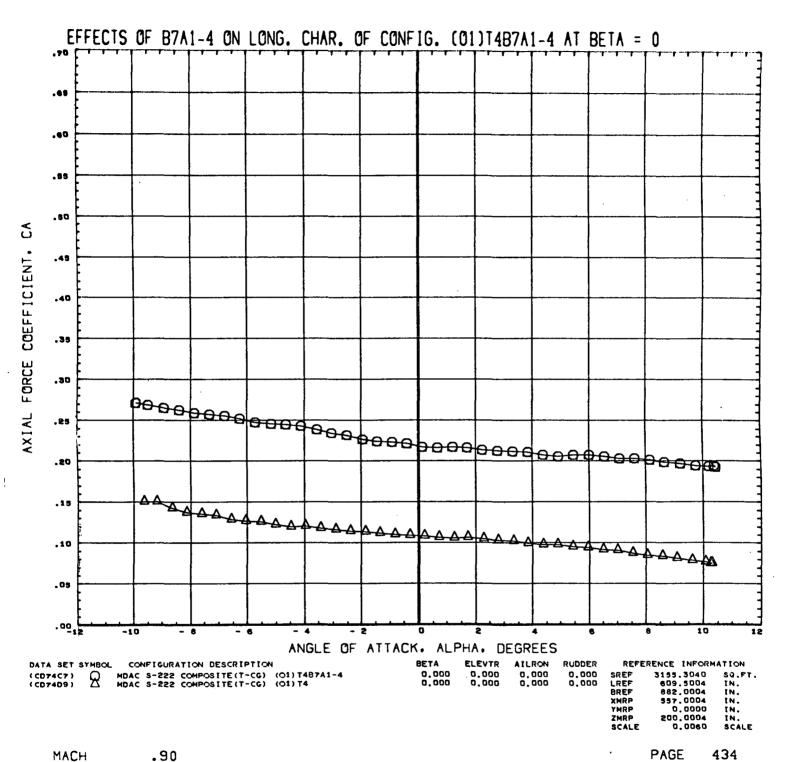
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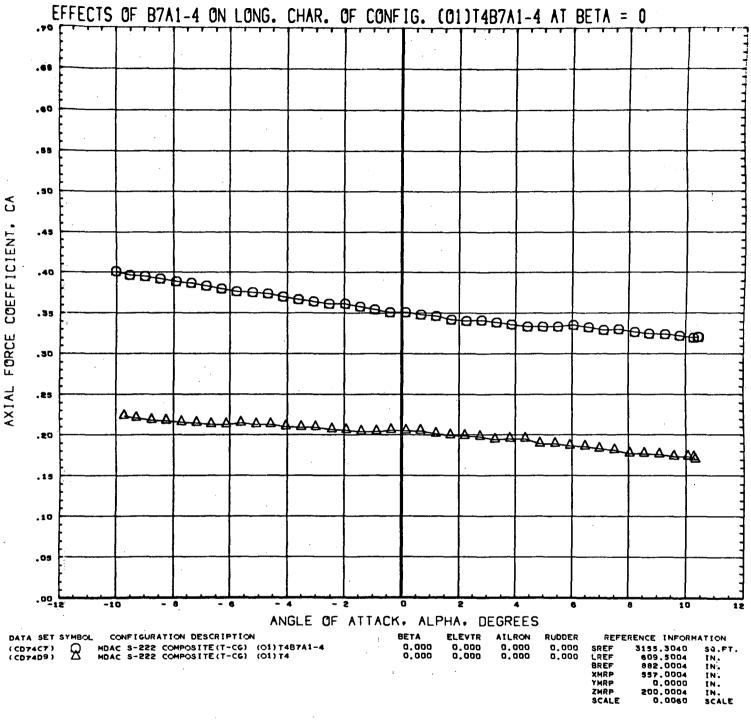
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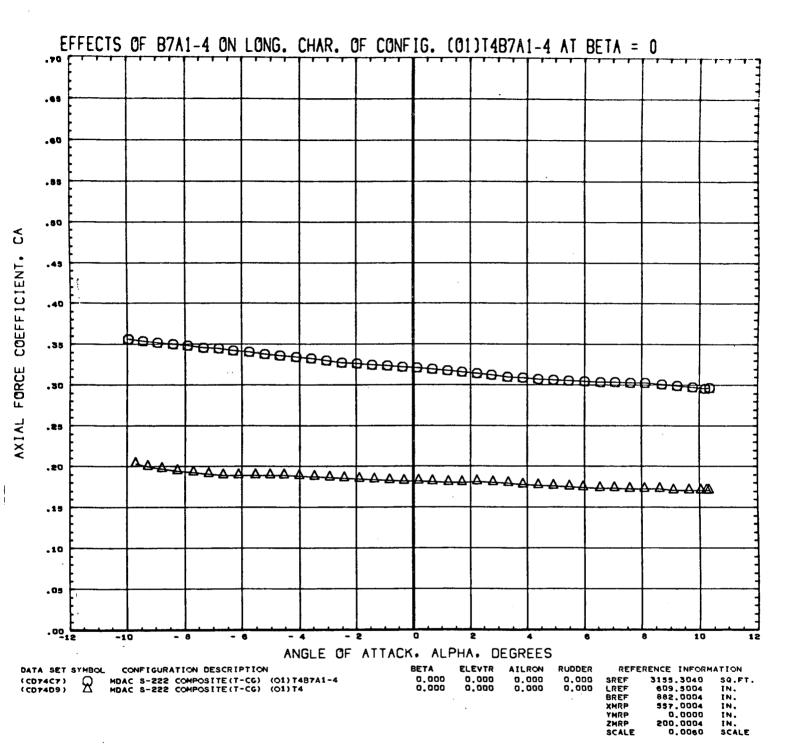
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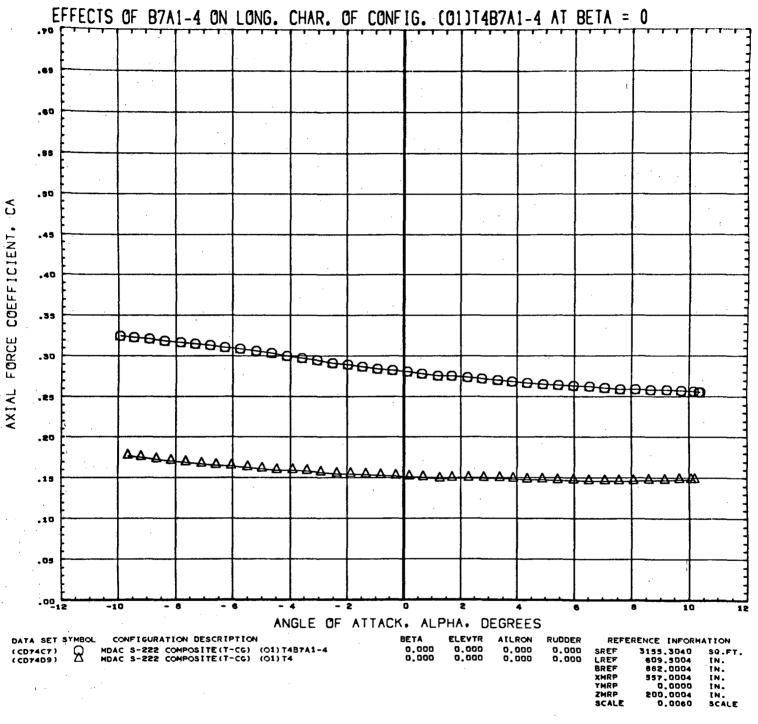




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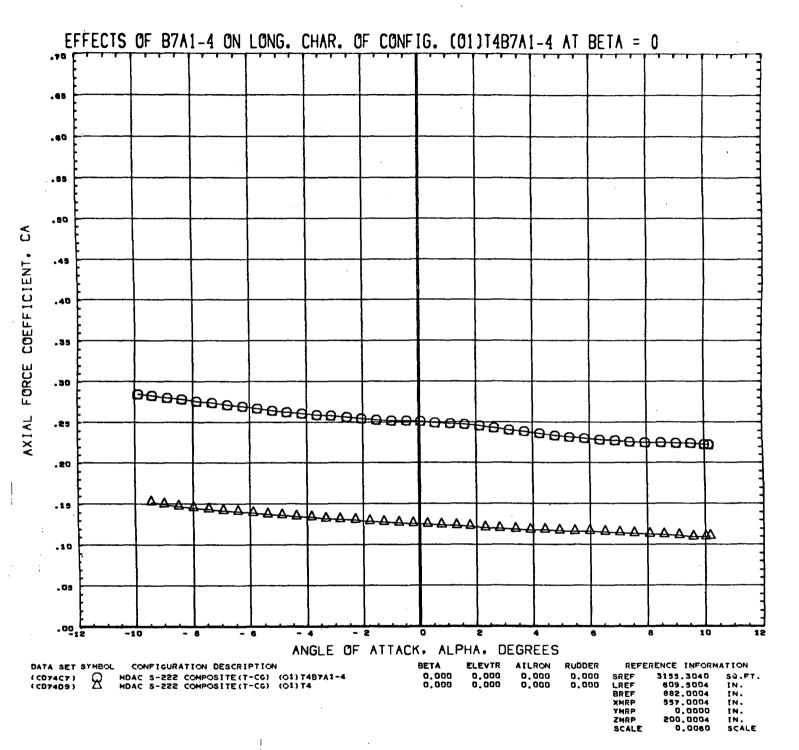


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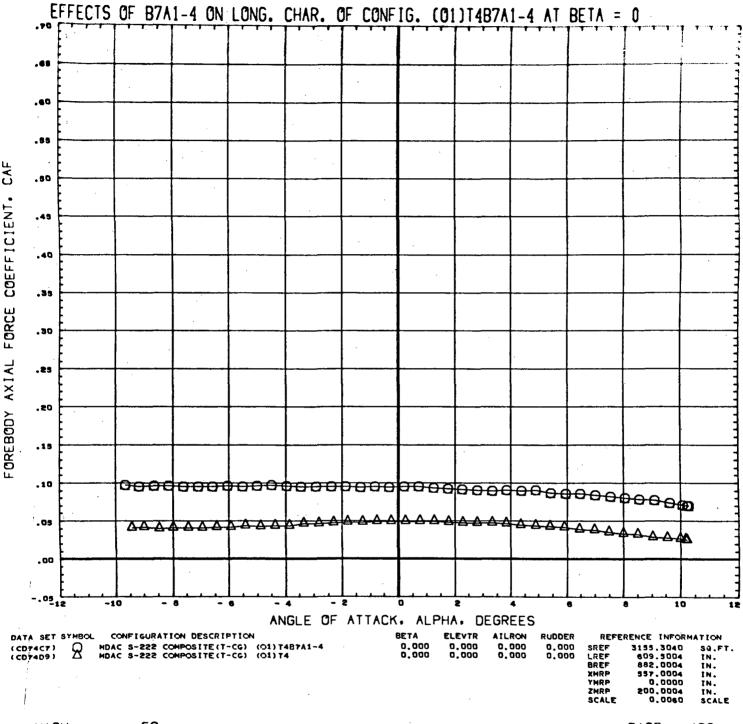
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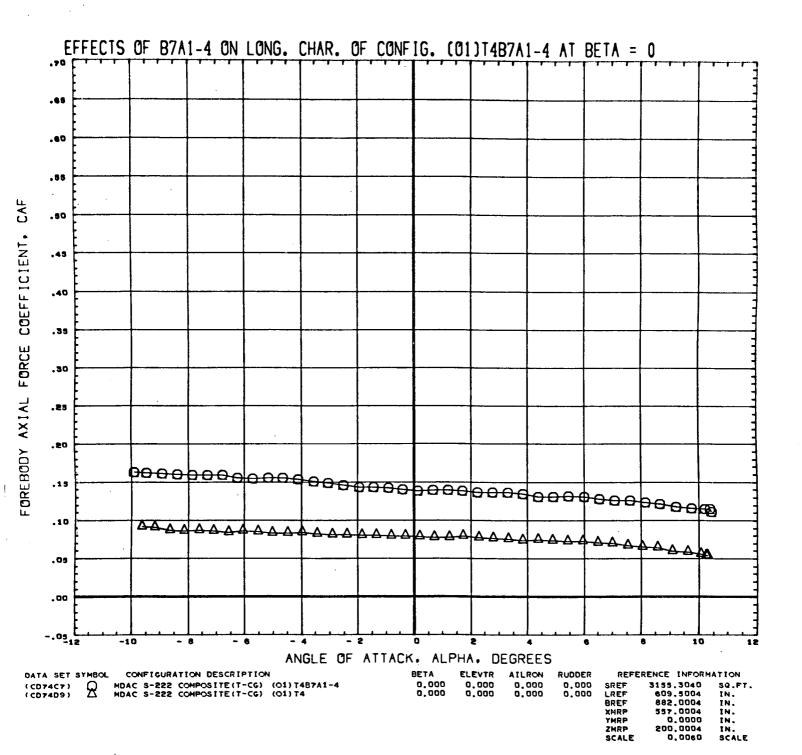
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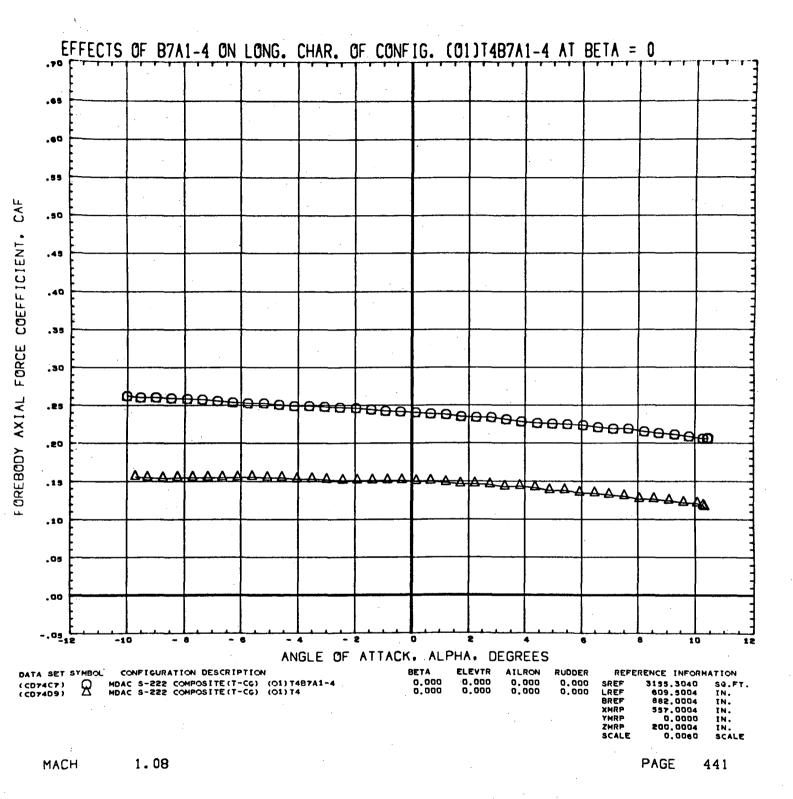


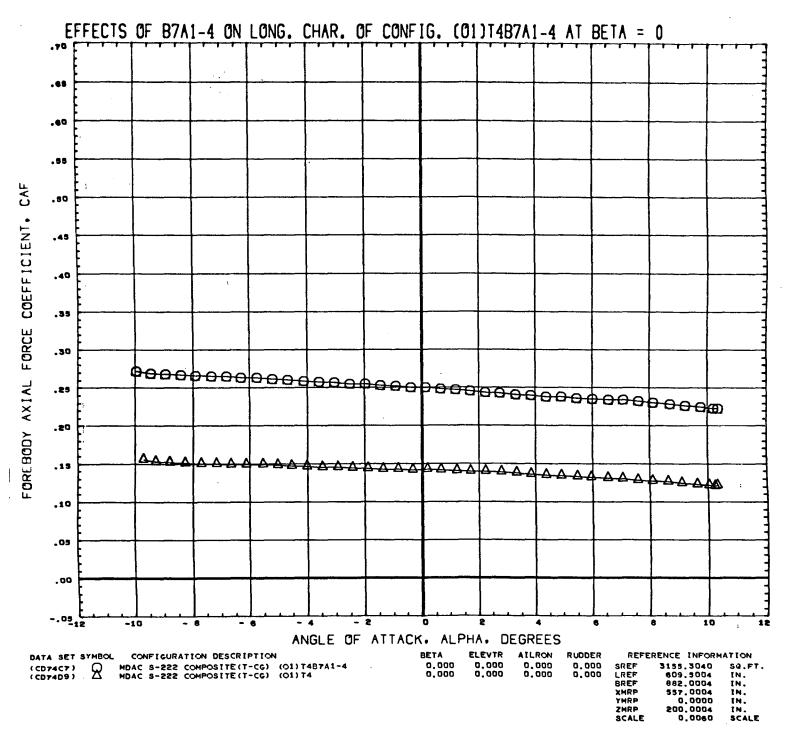
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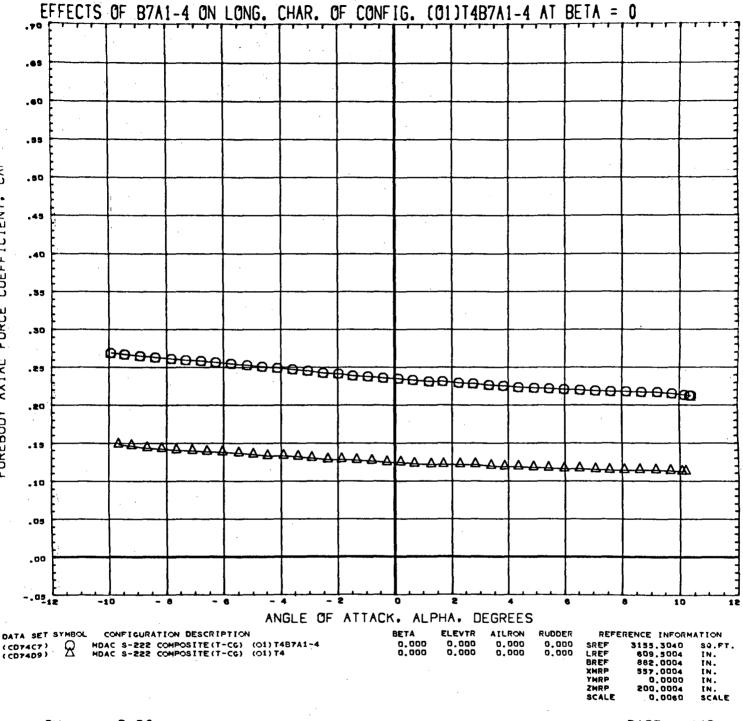
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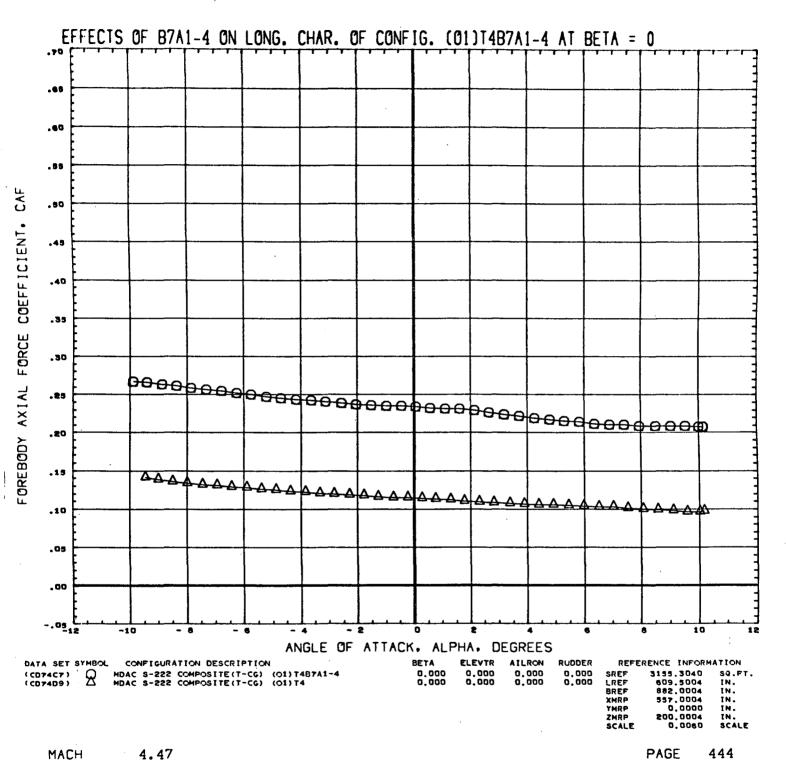
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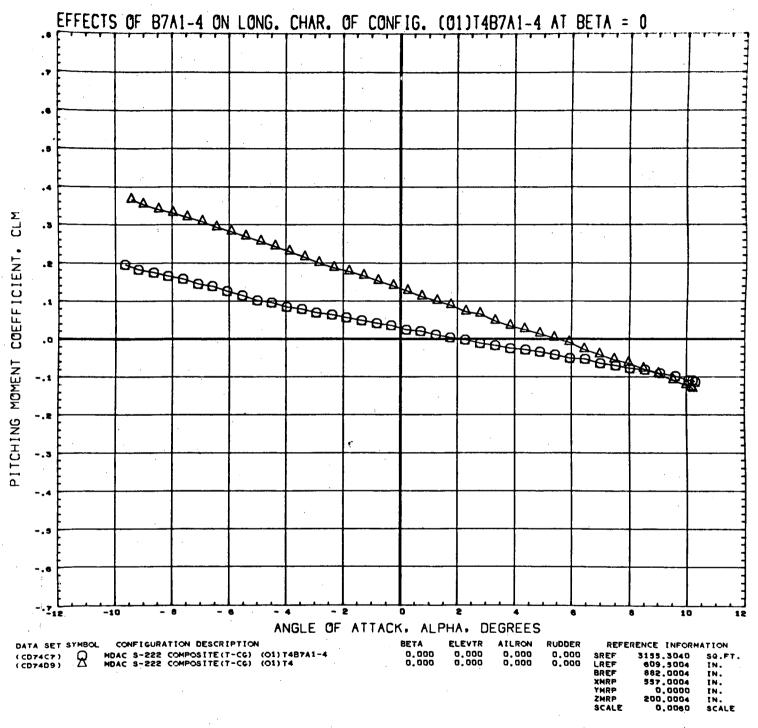


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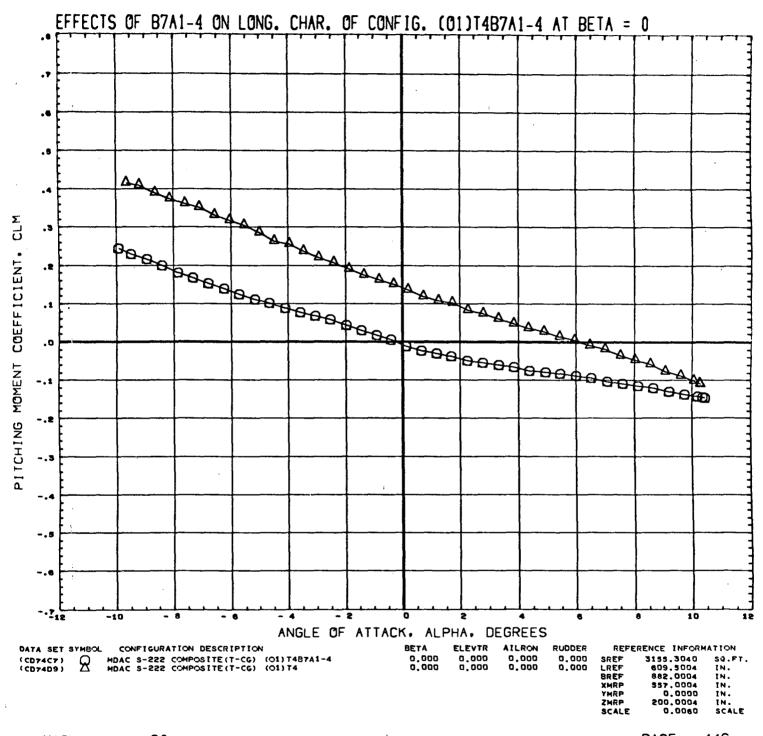
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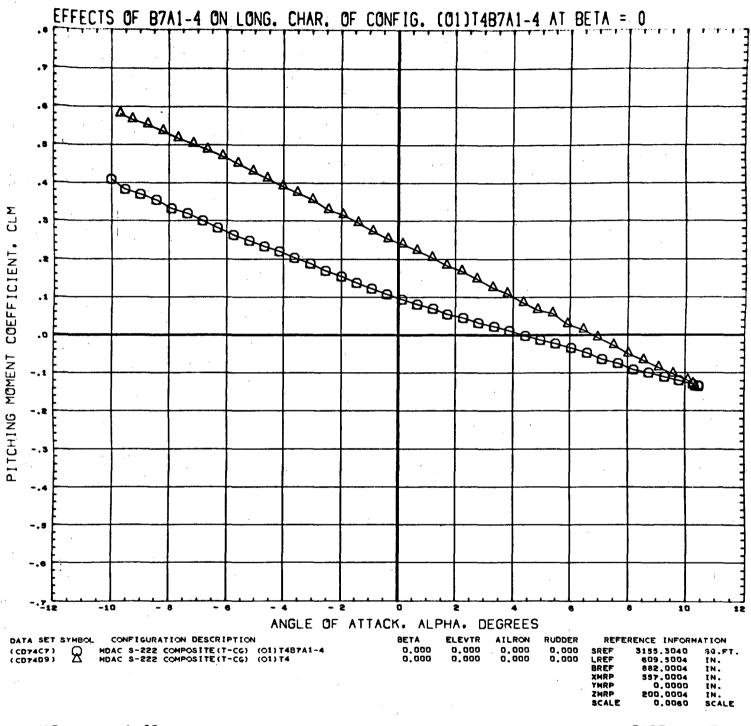




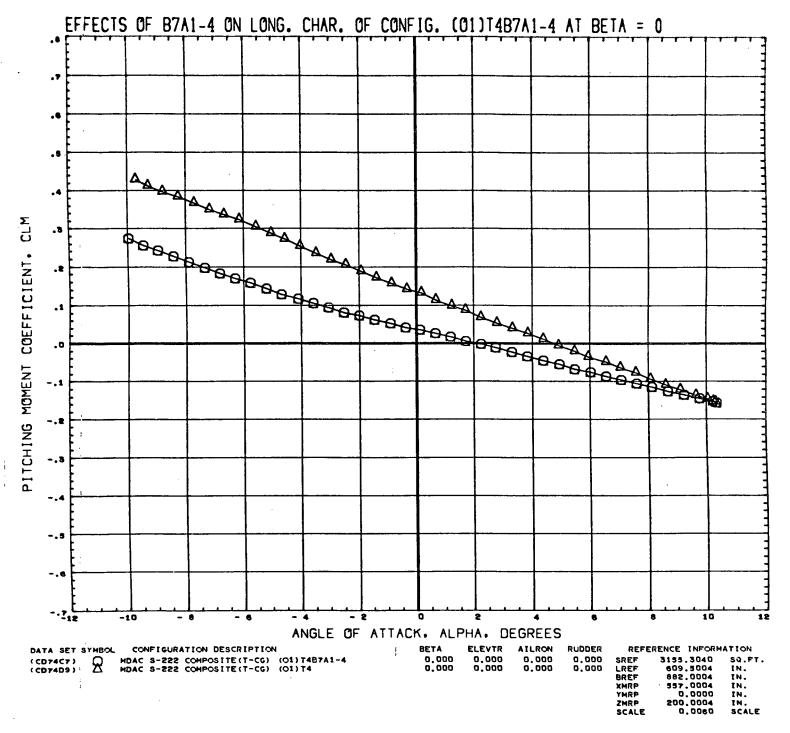
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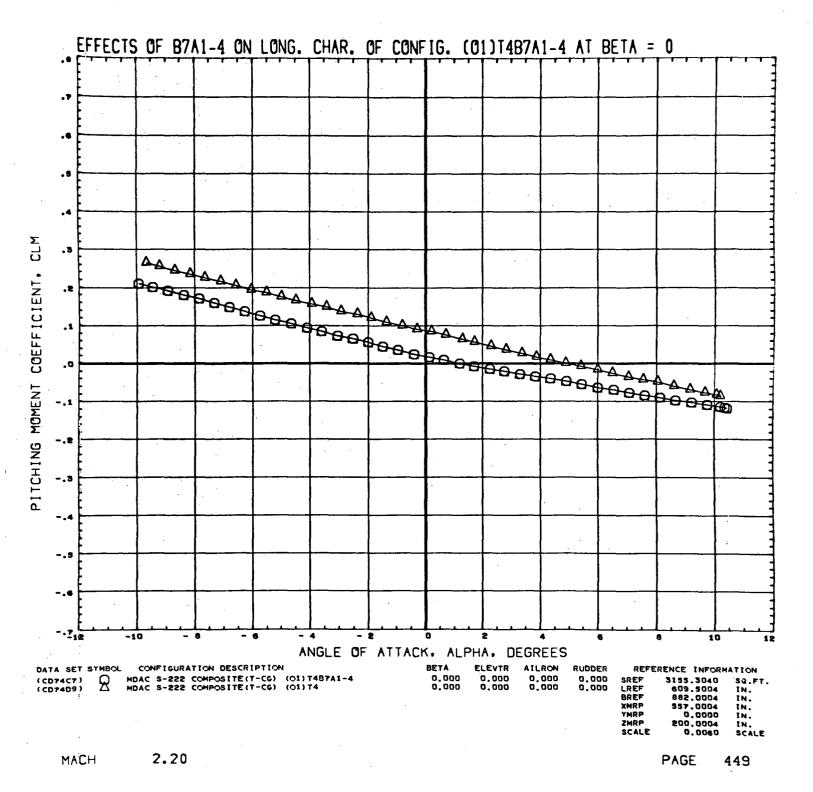
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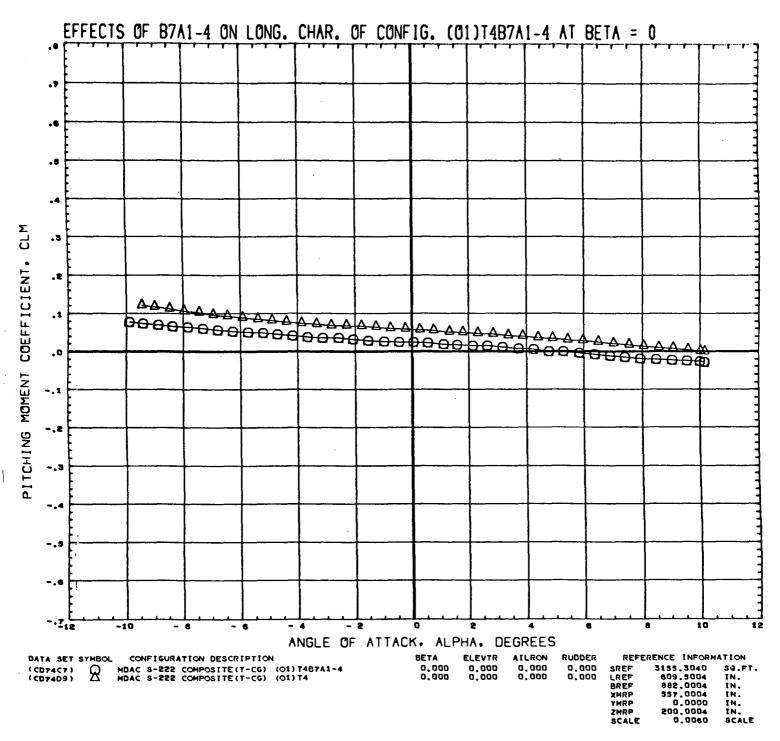


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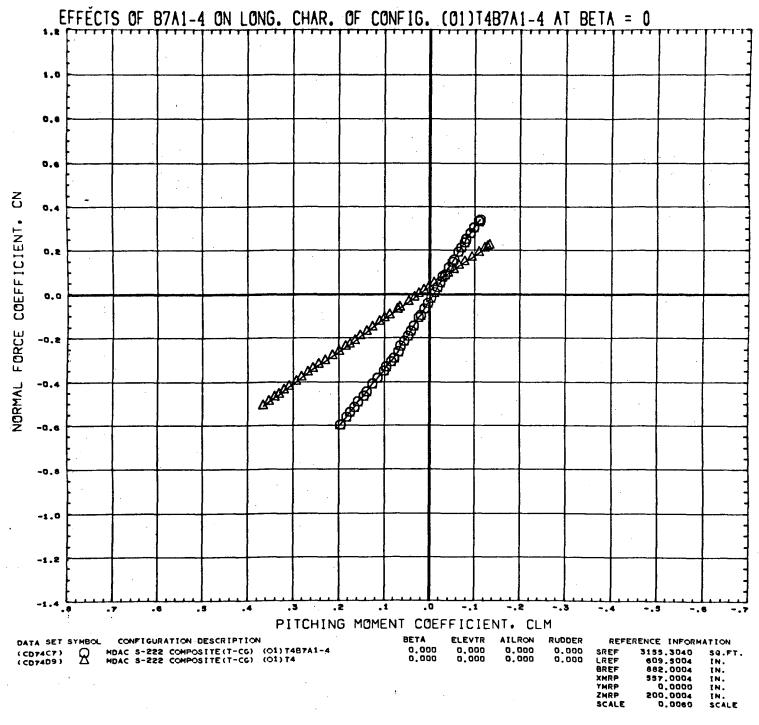


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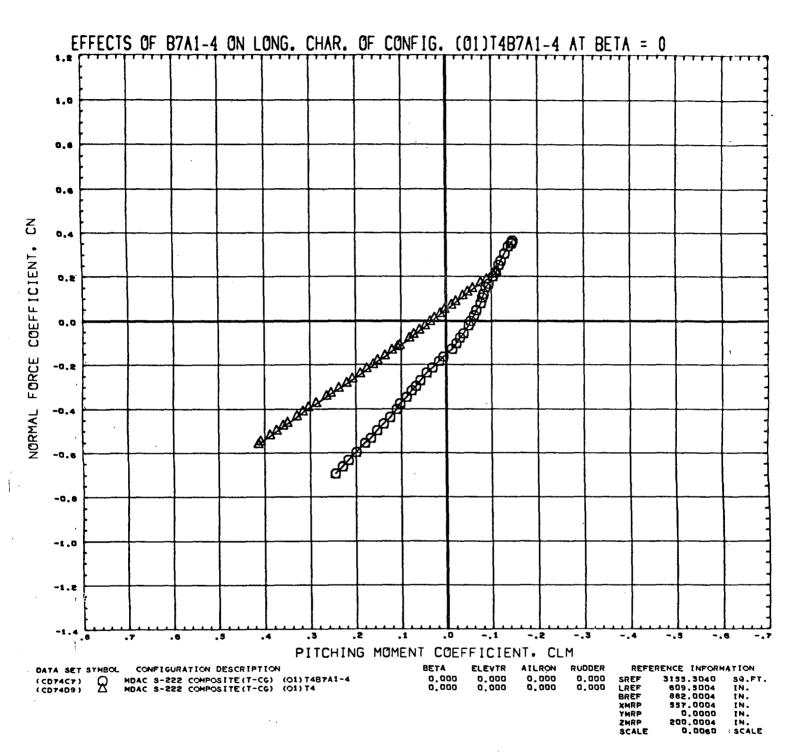


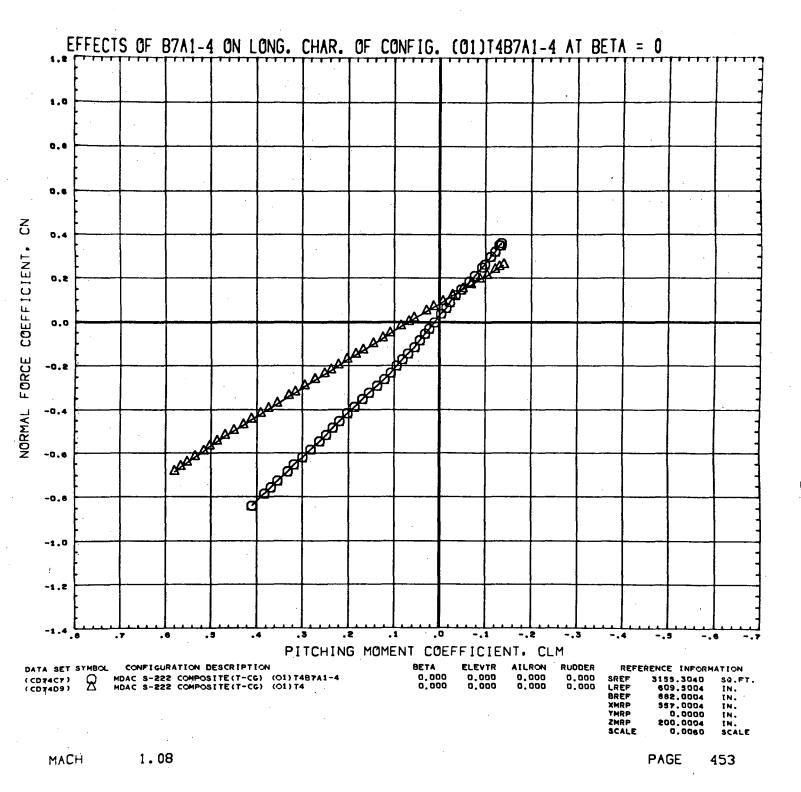


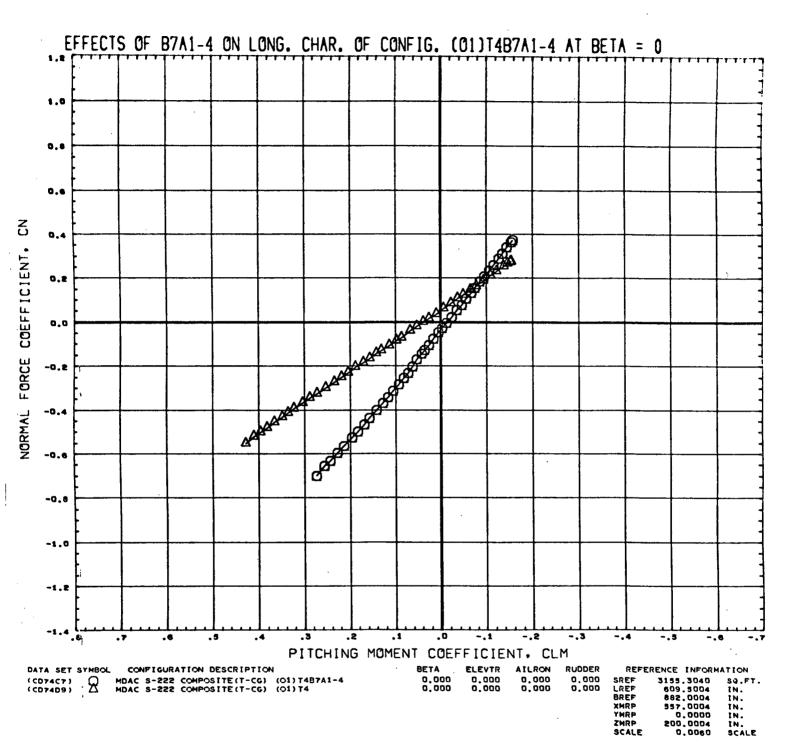
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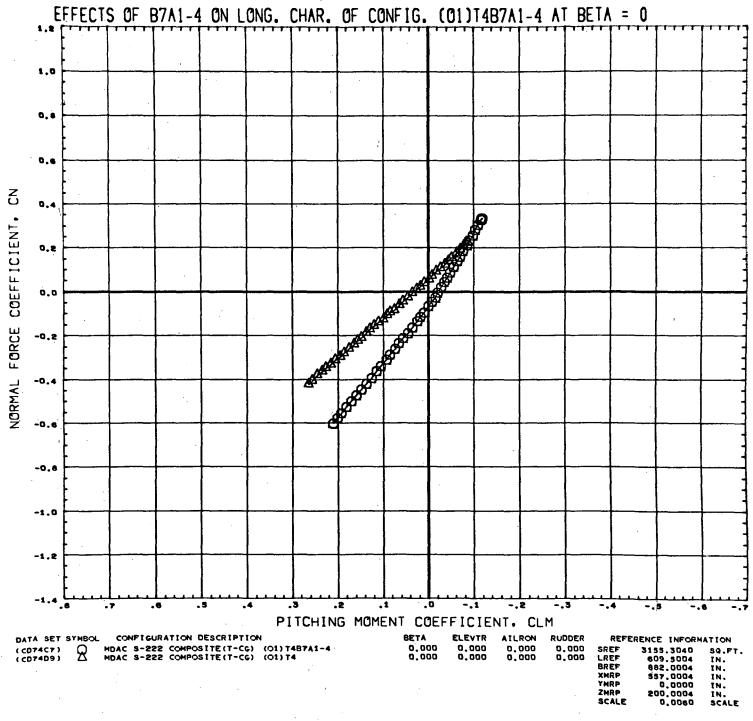




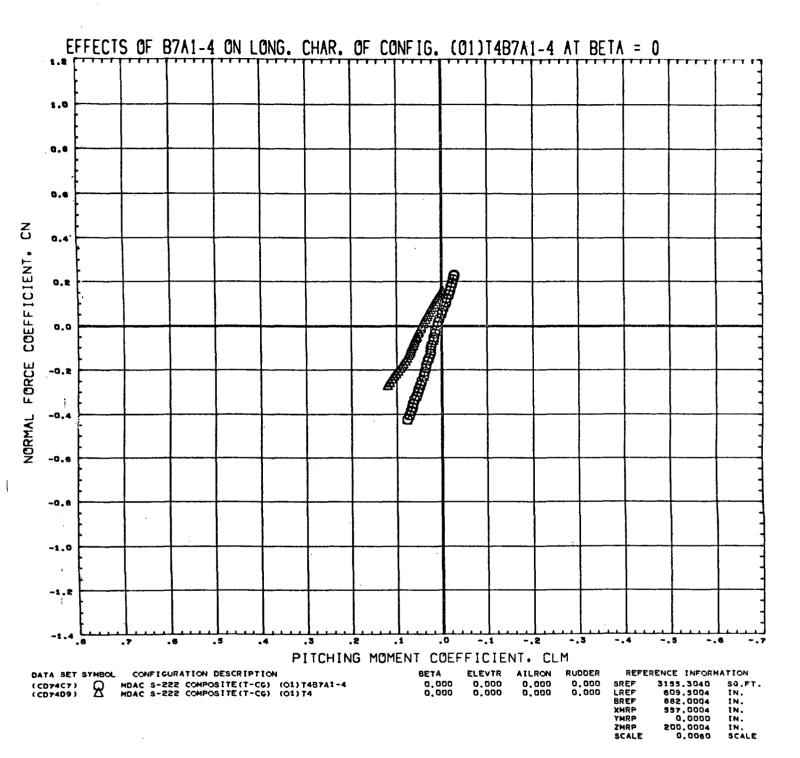


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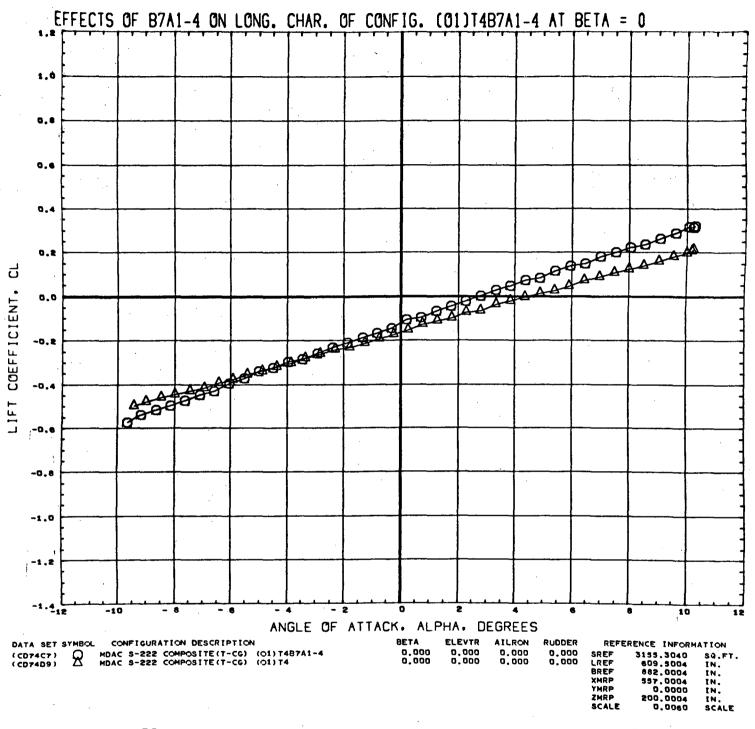


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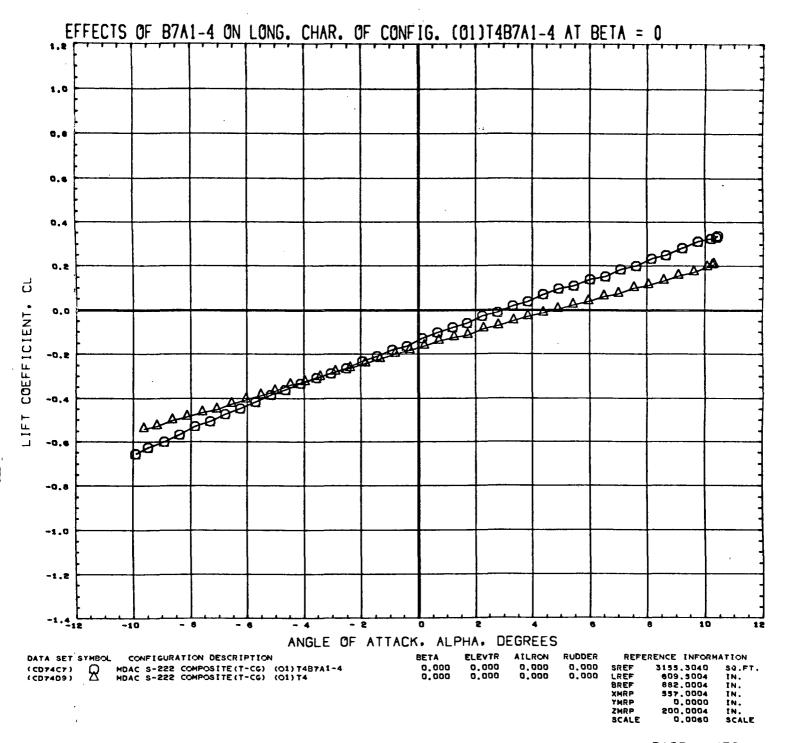


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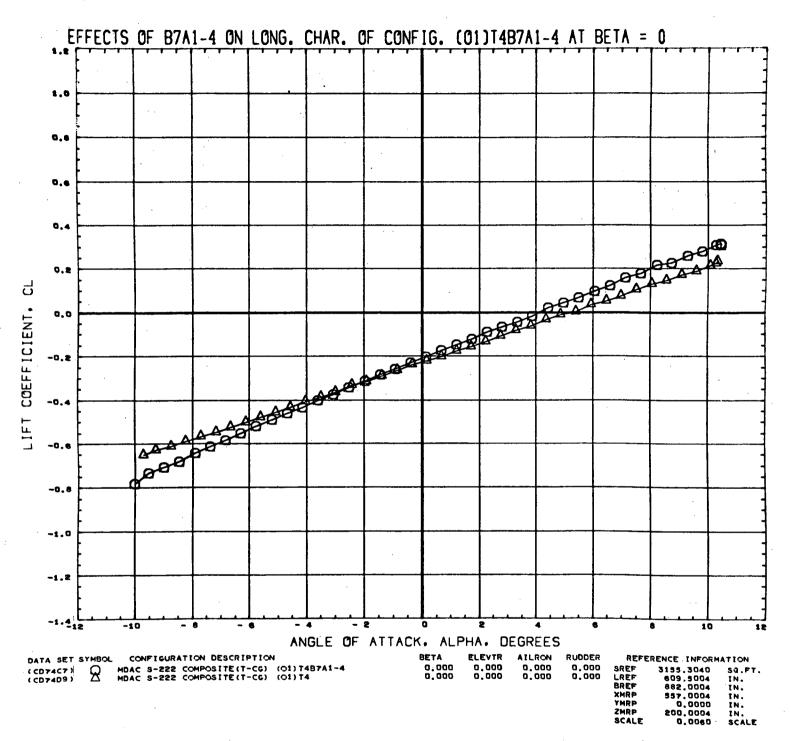
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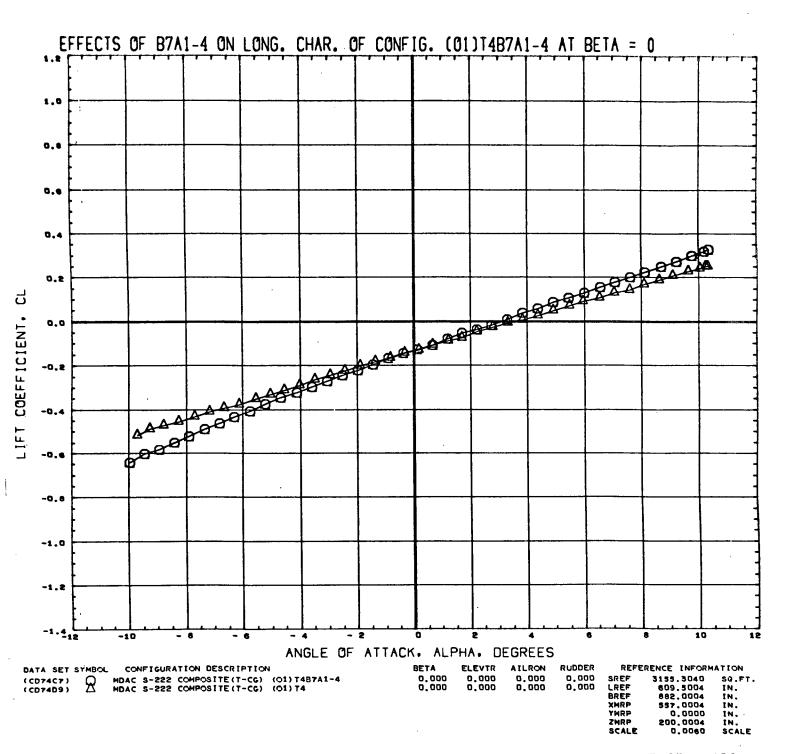
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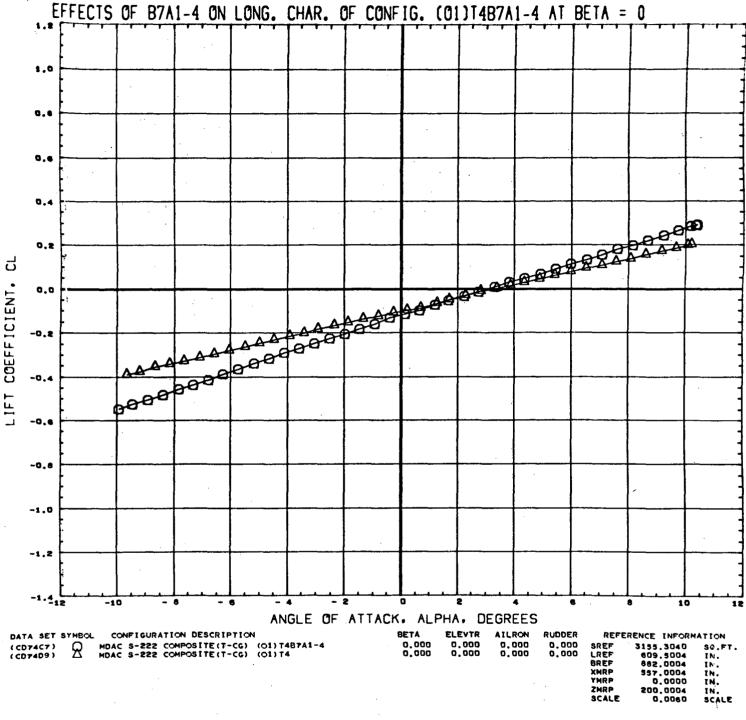
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MACH 1.08

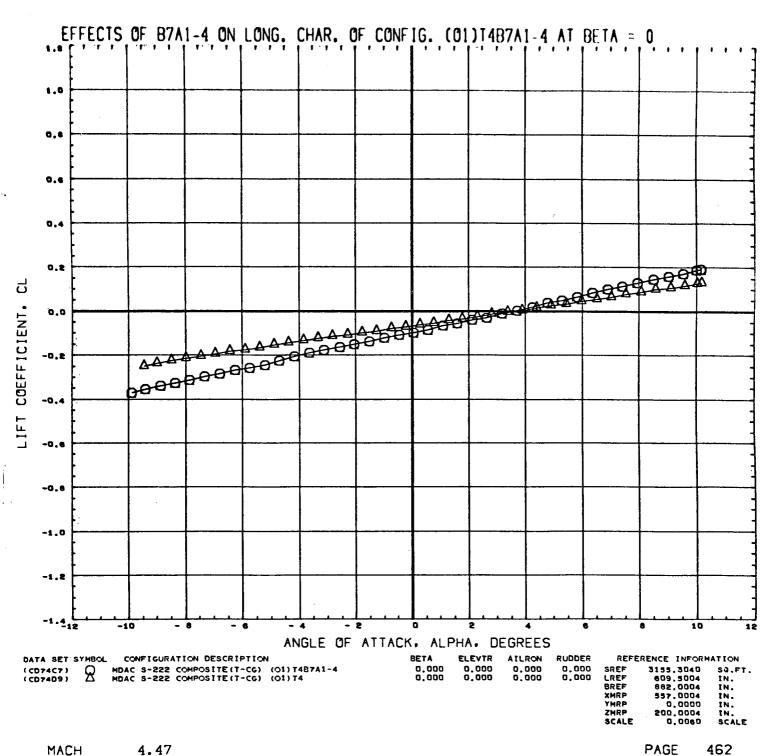


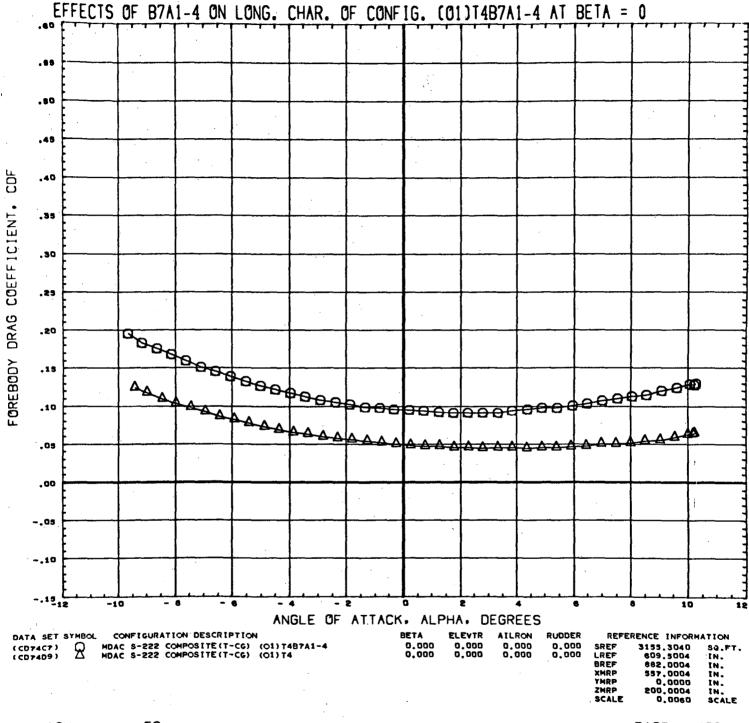
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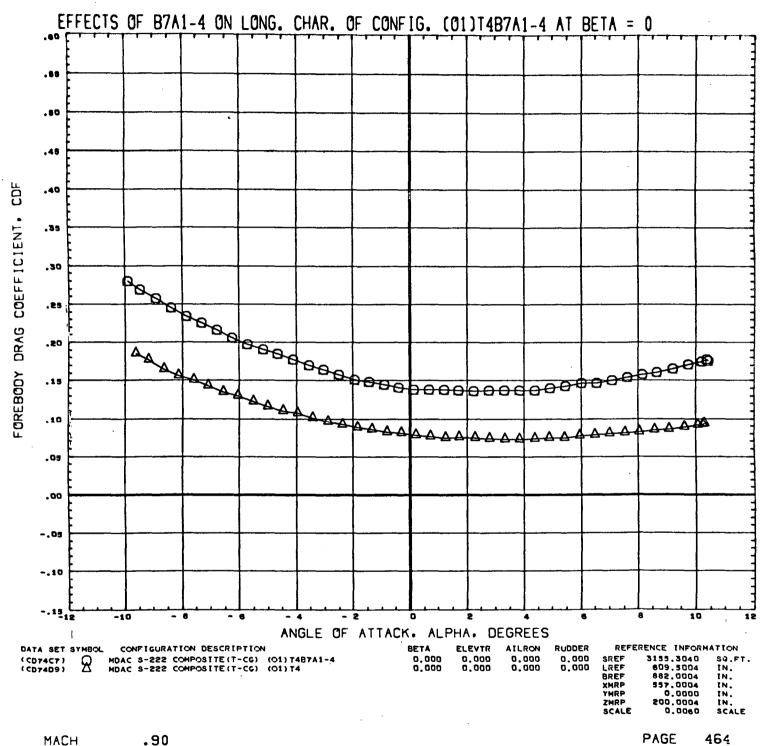
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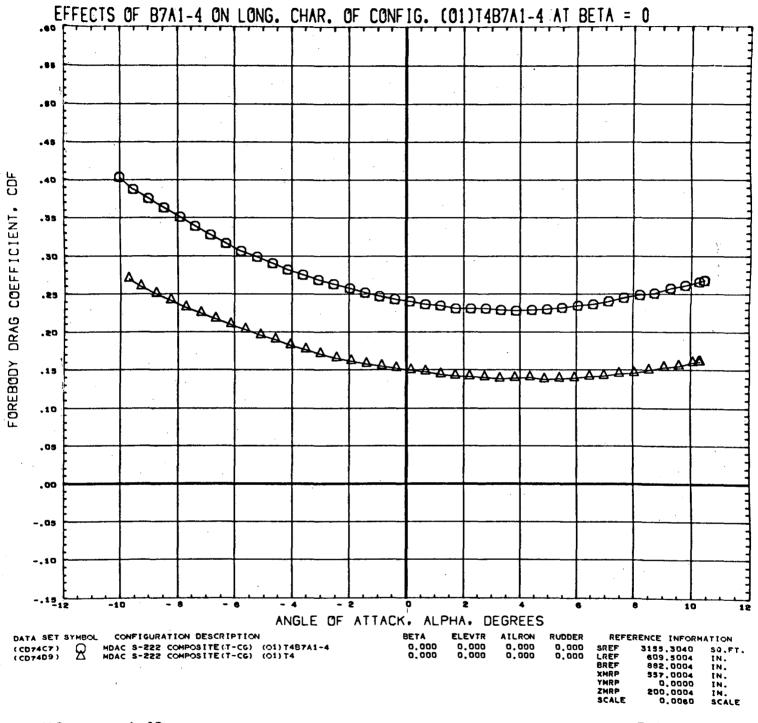
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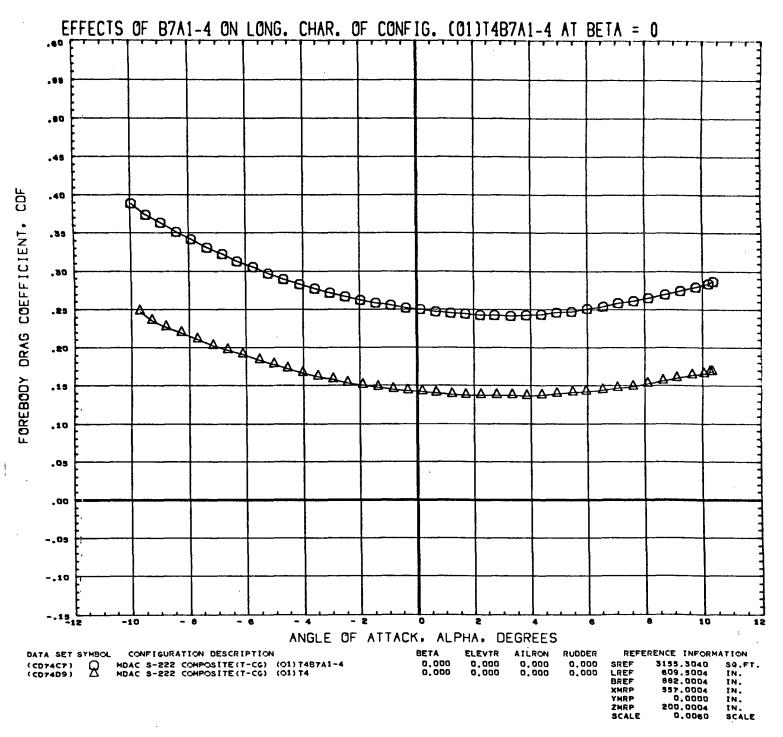


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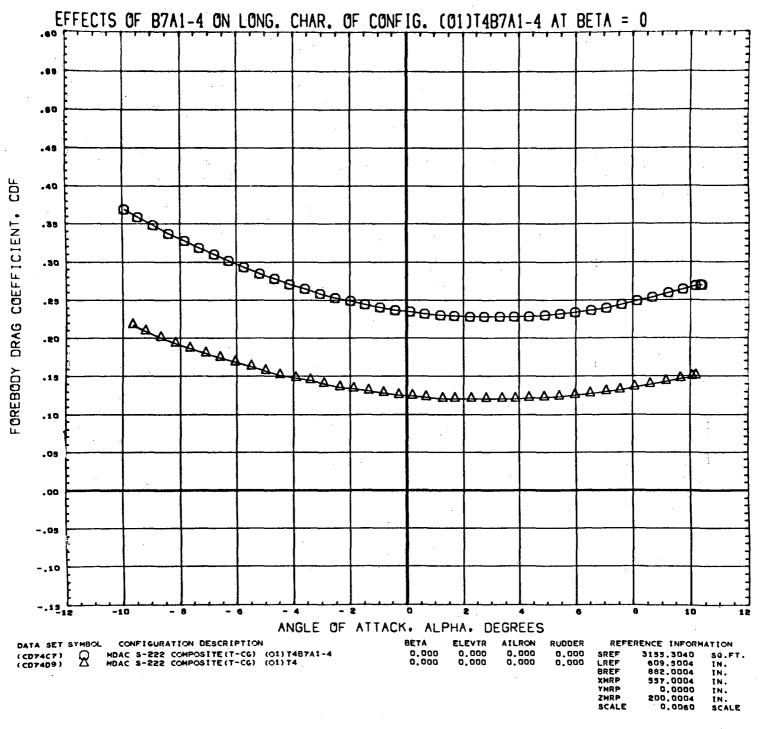




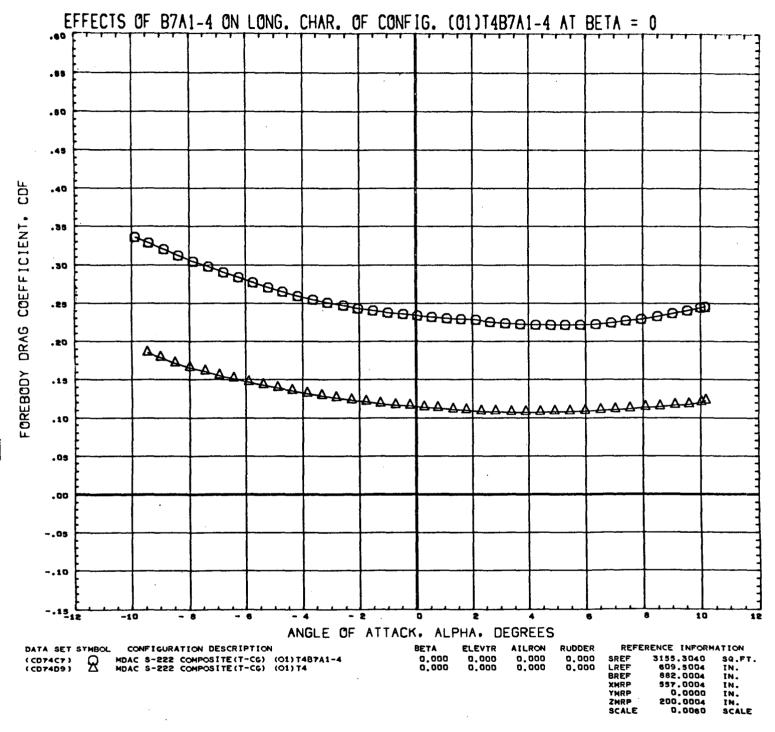
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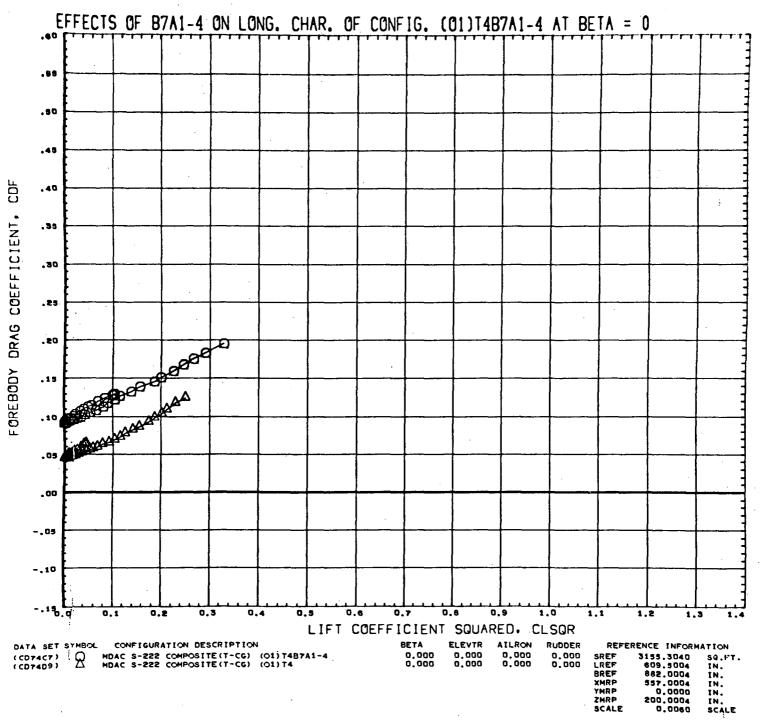
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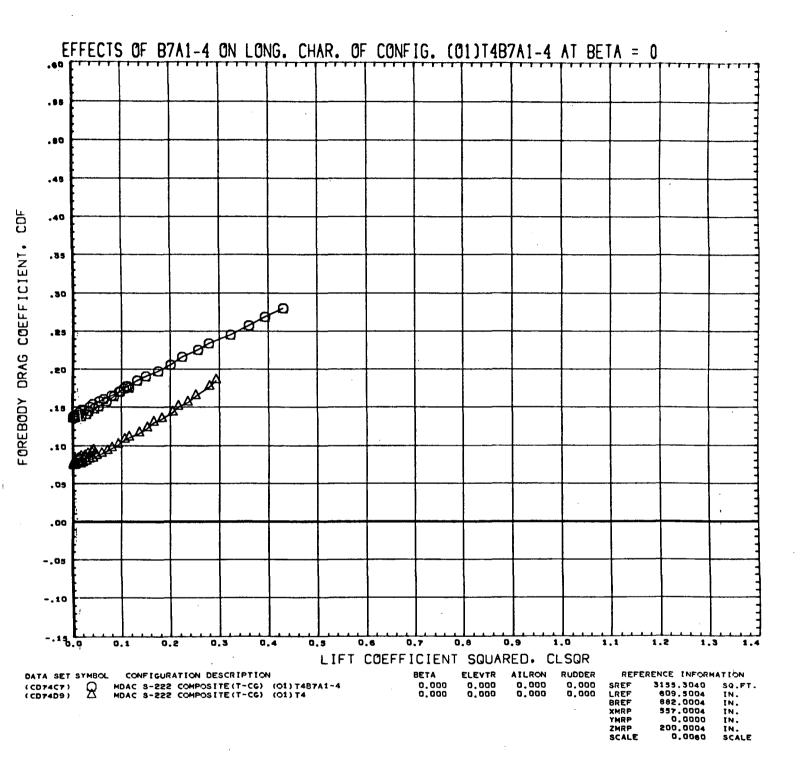
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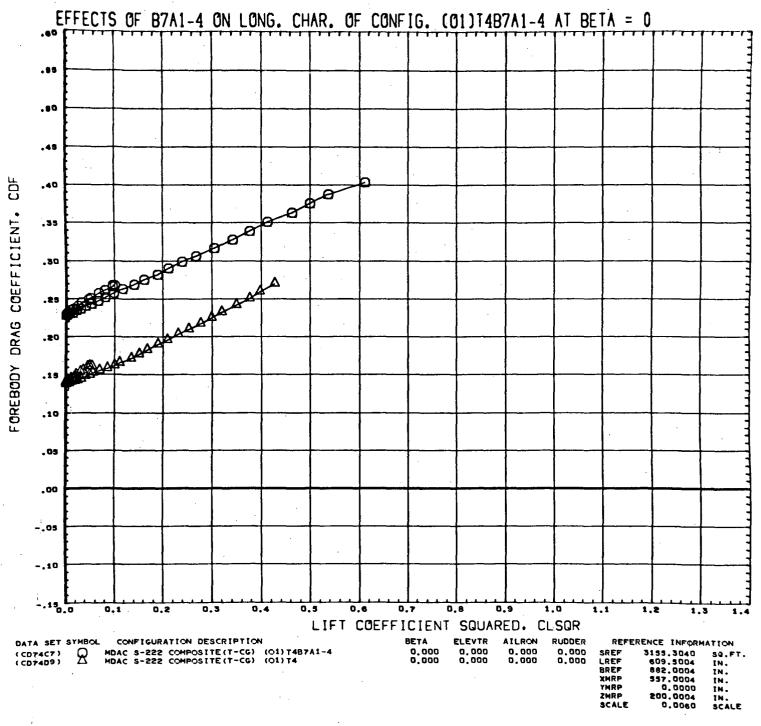


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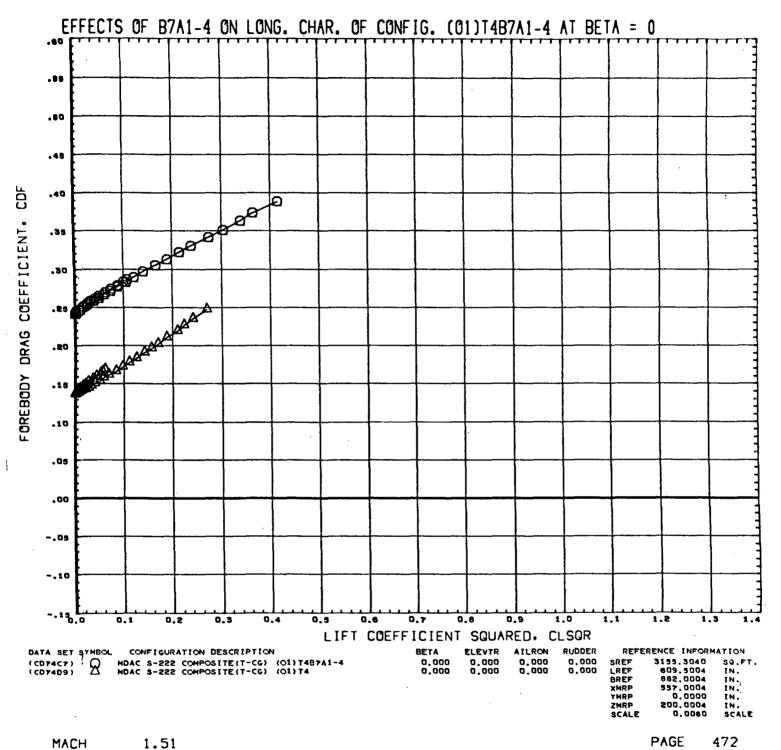


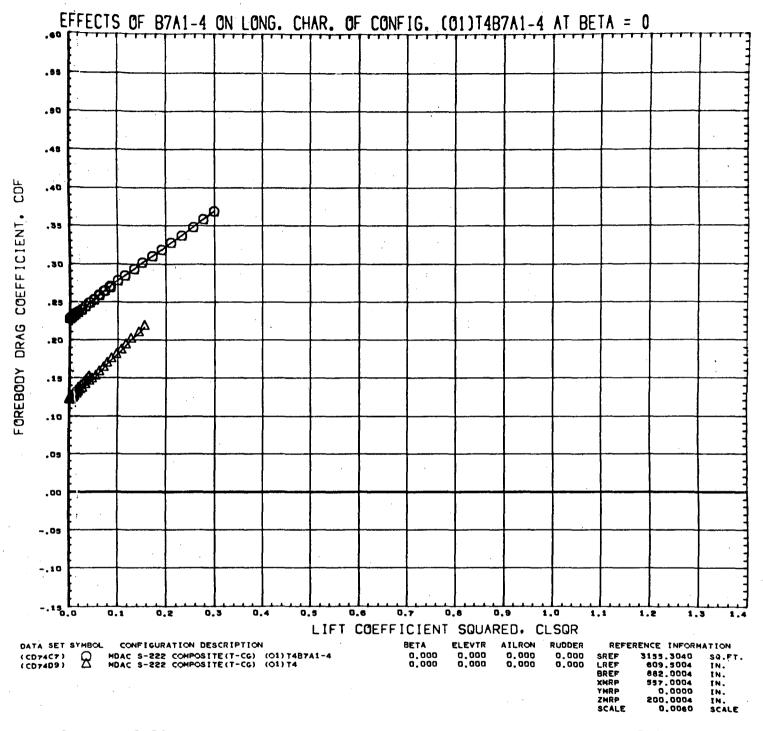
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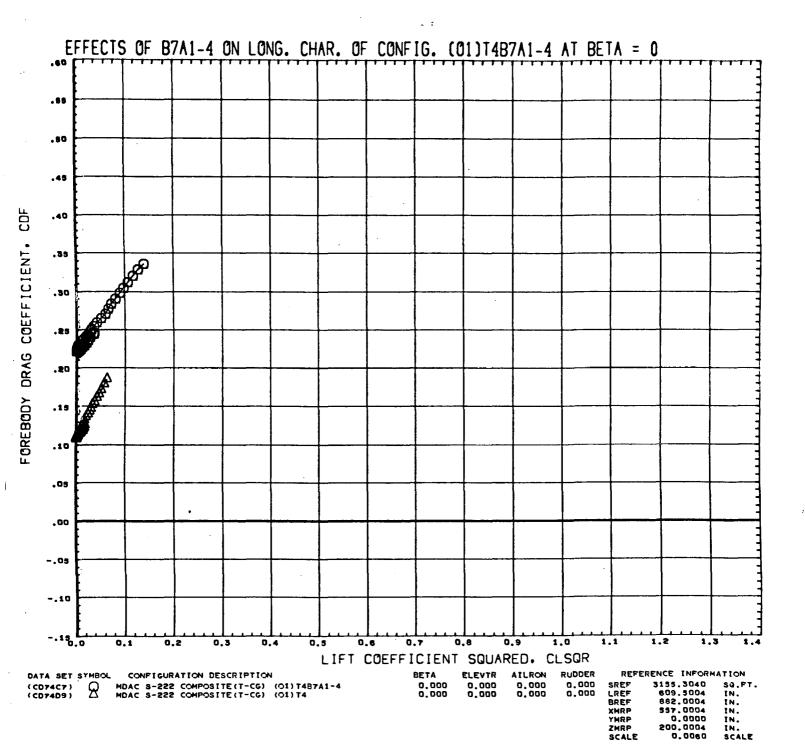


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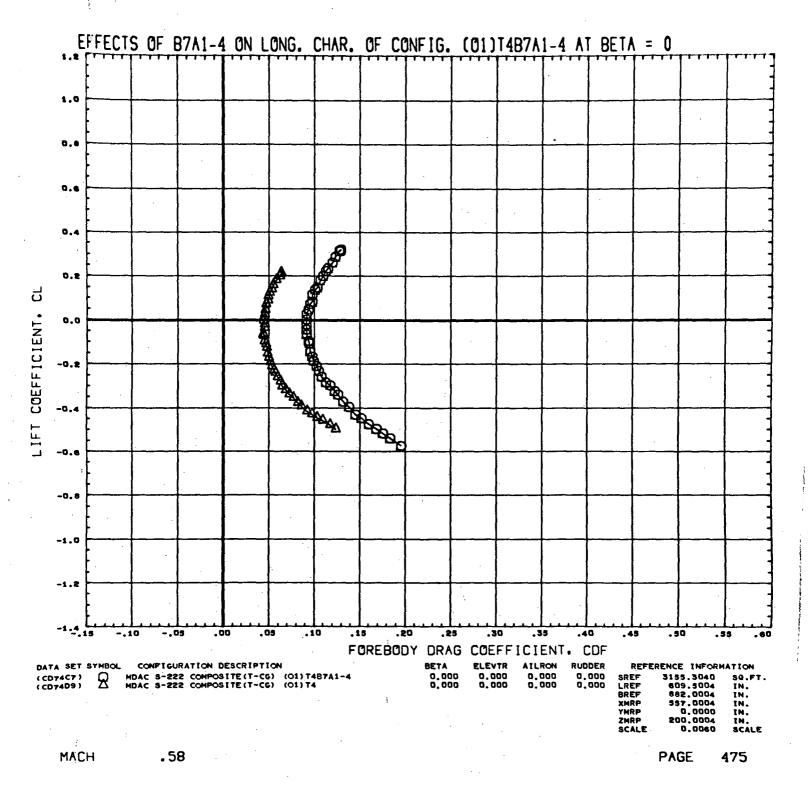


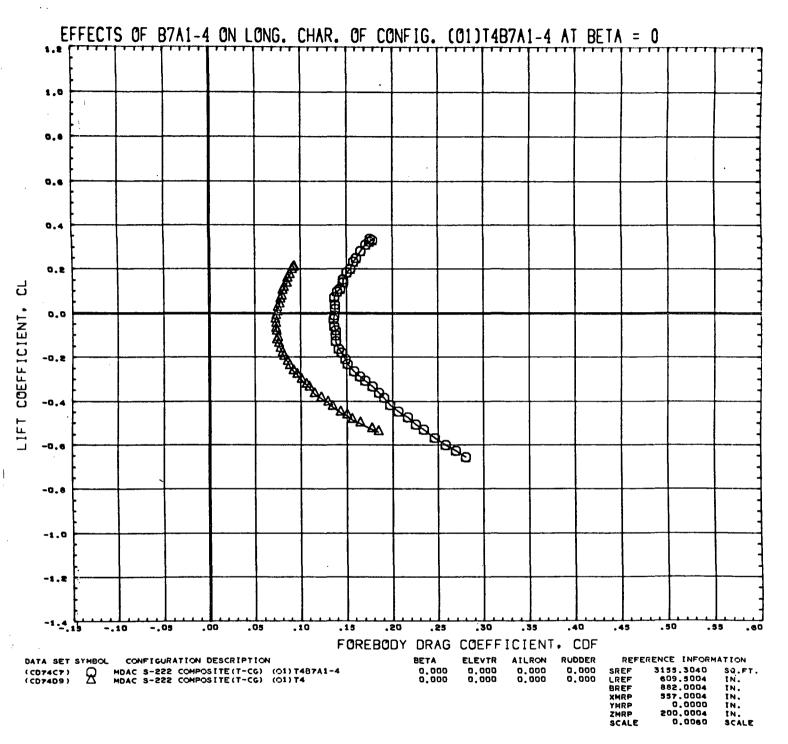


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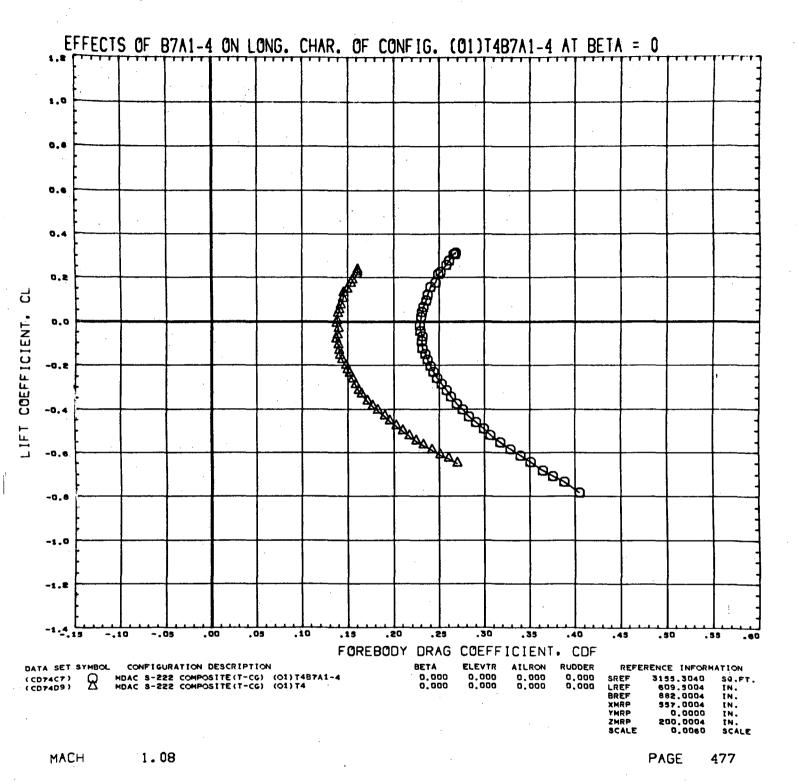


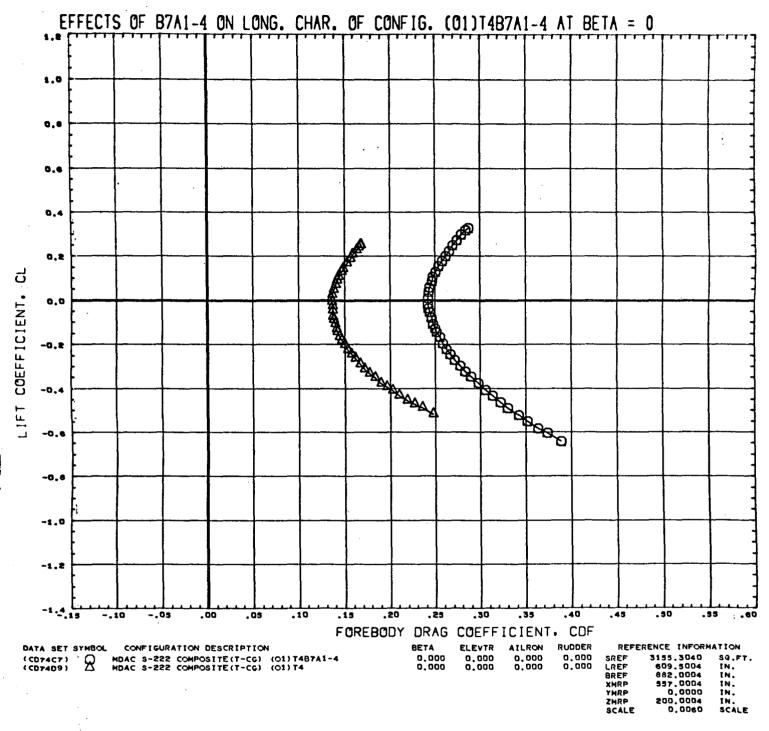
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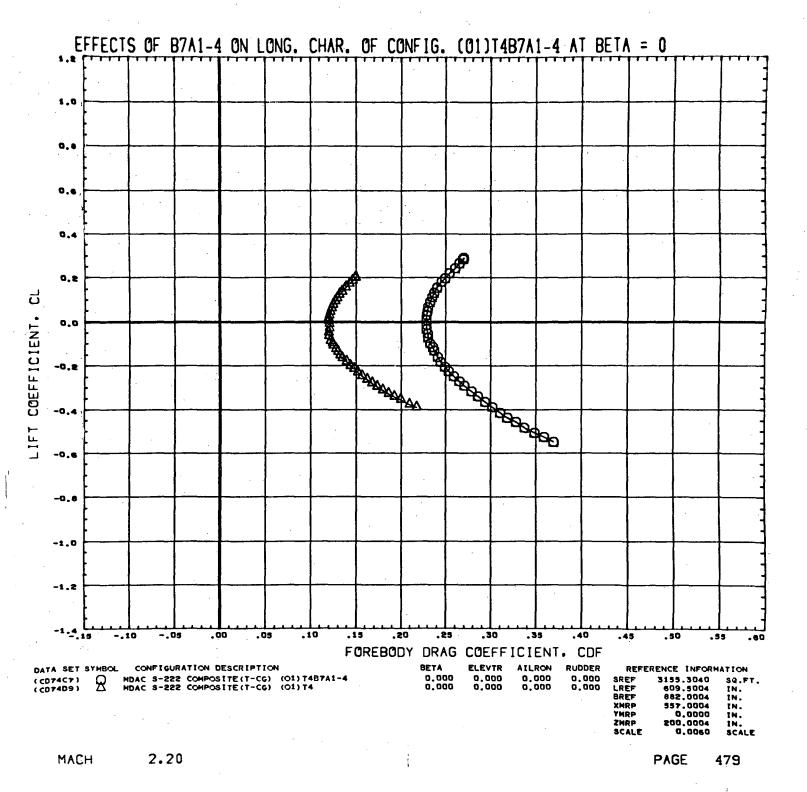


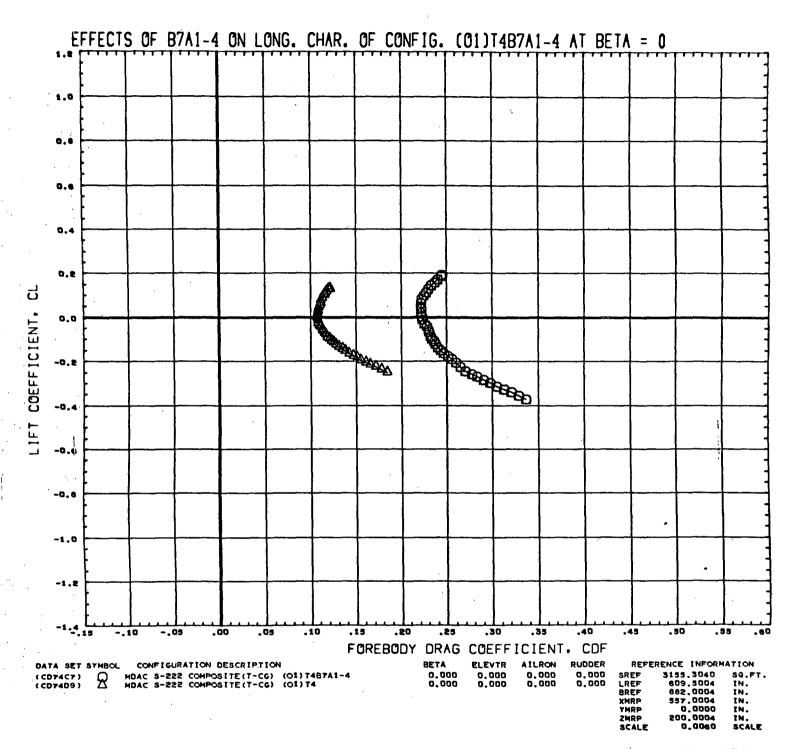
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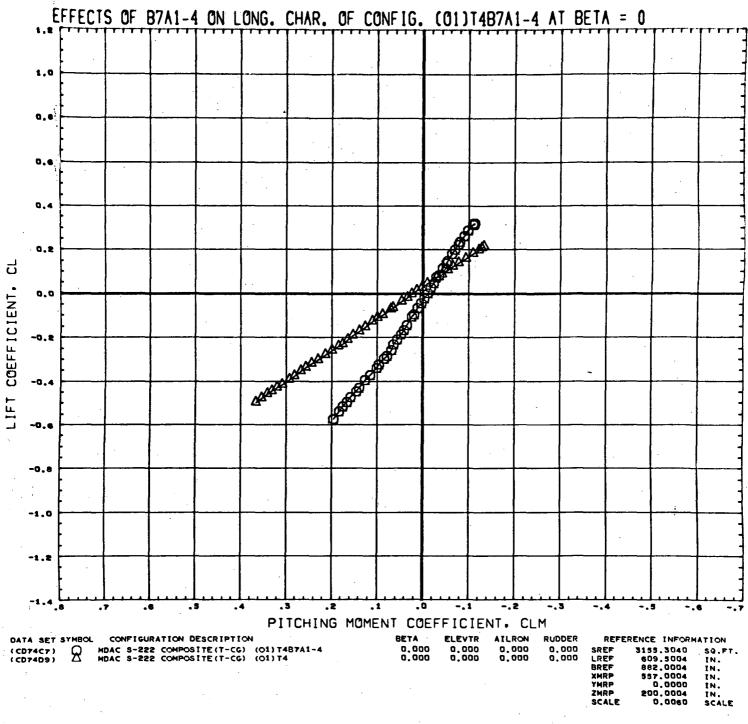


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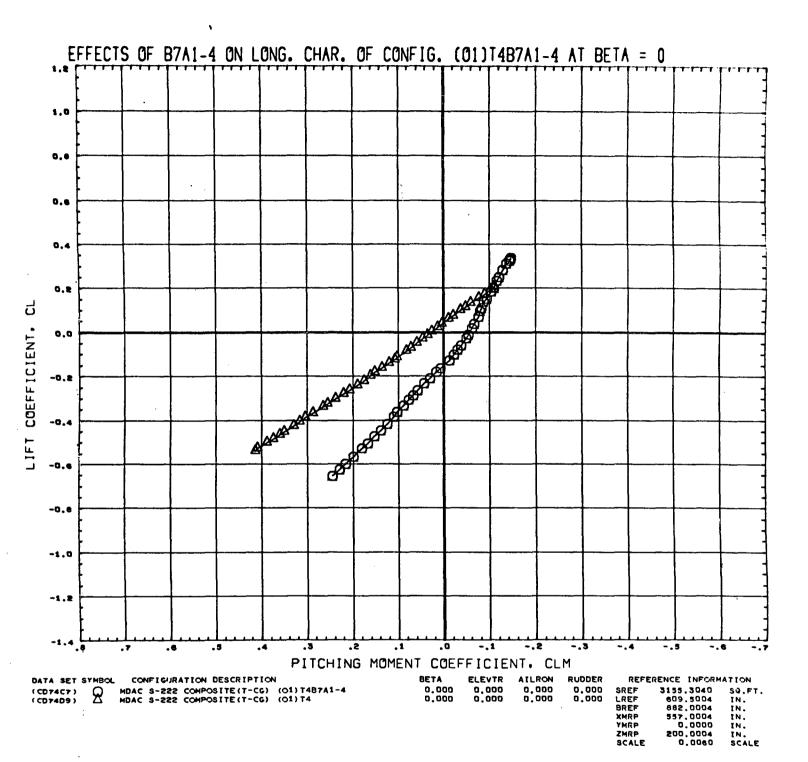




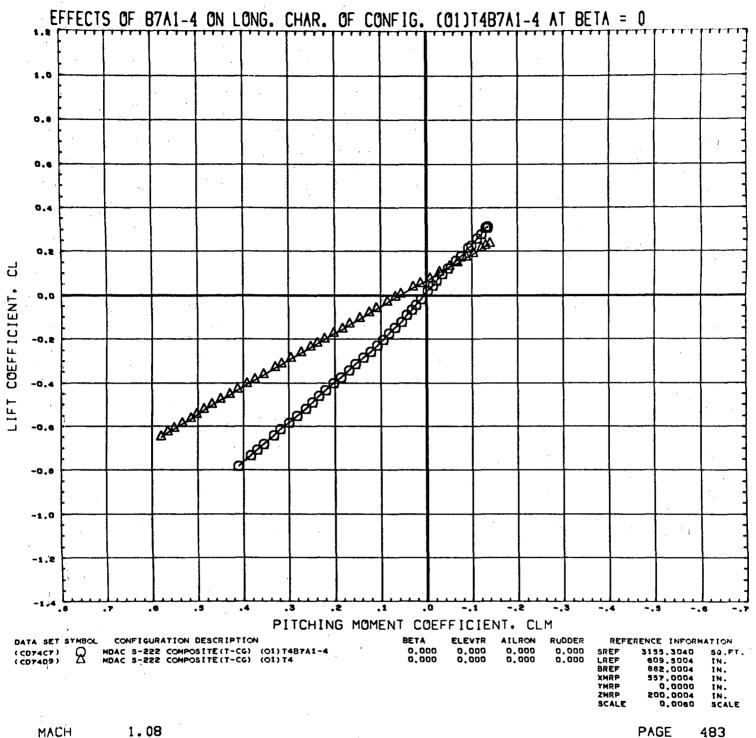
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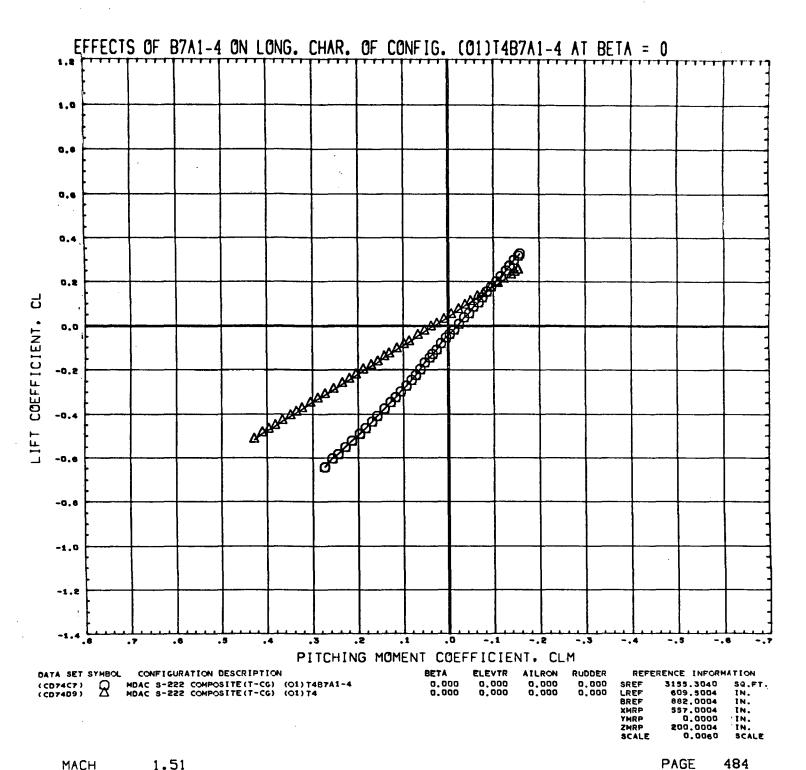
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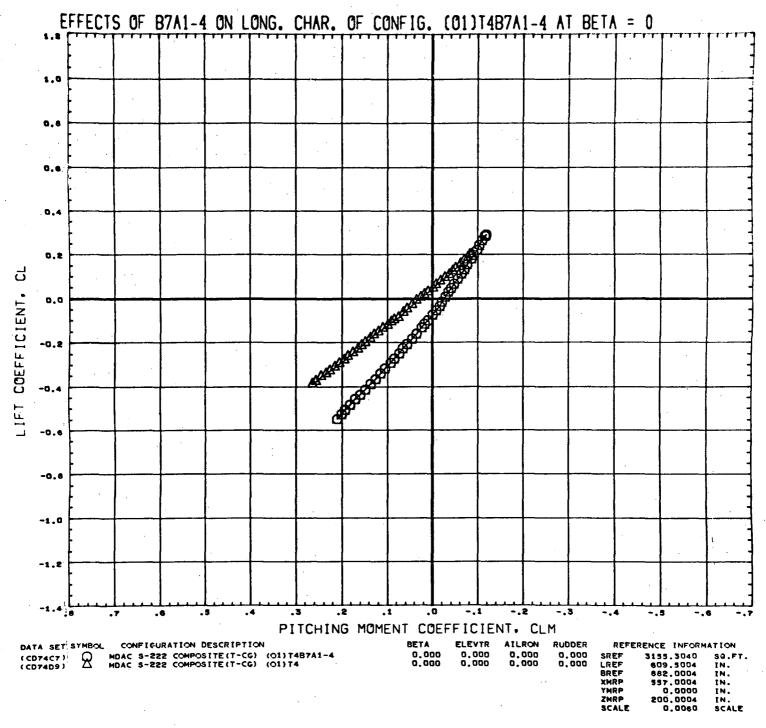


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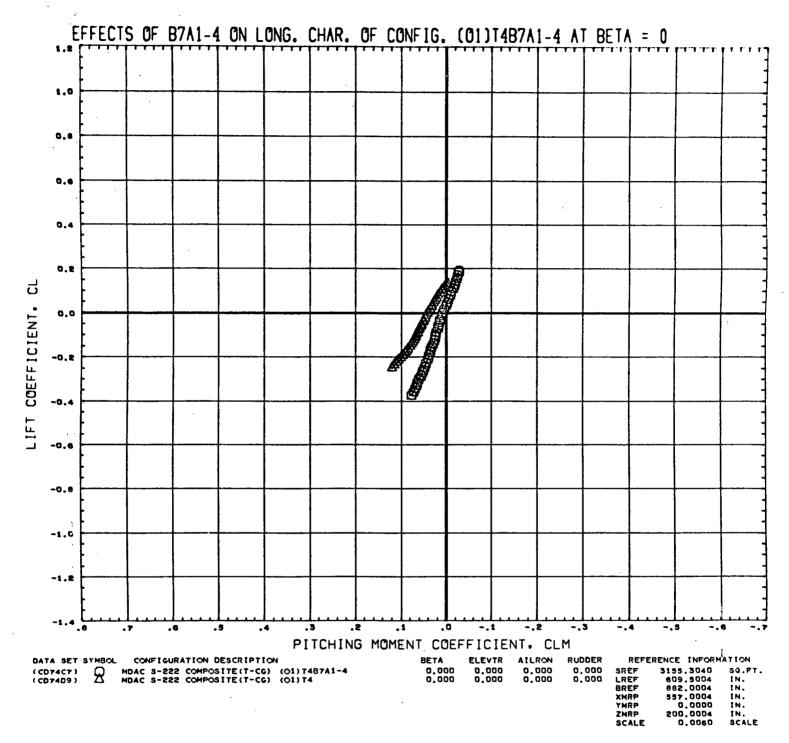


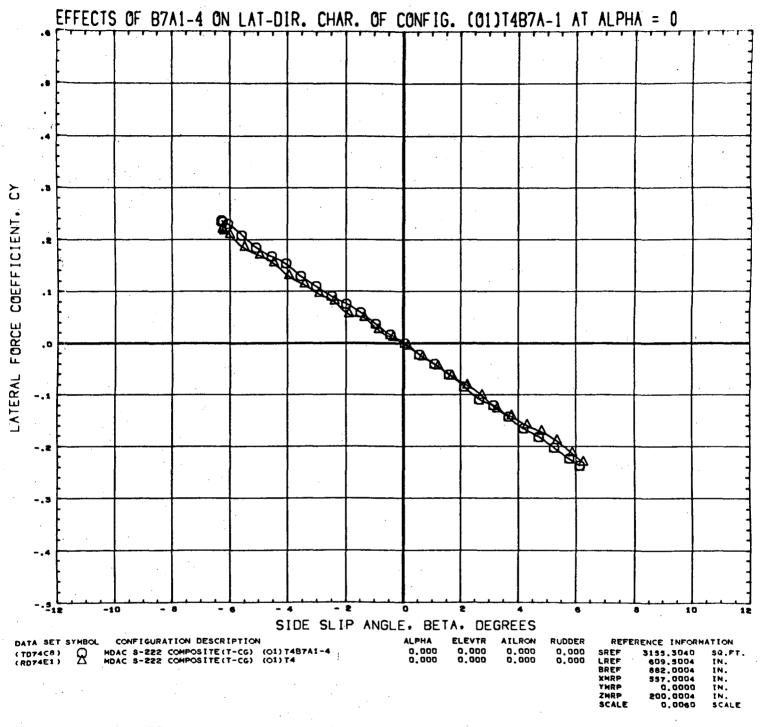
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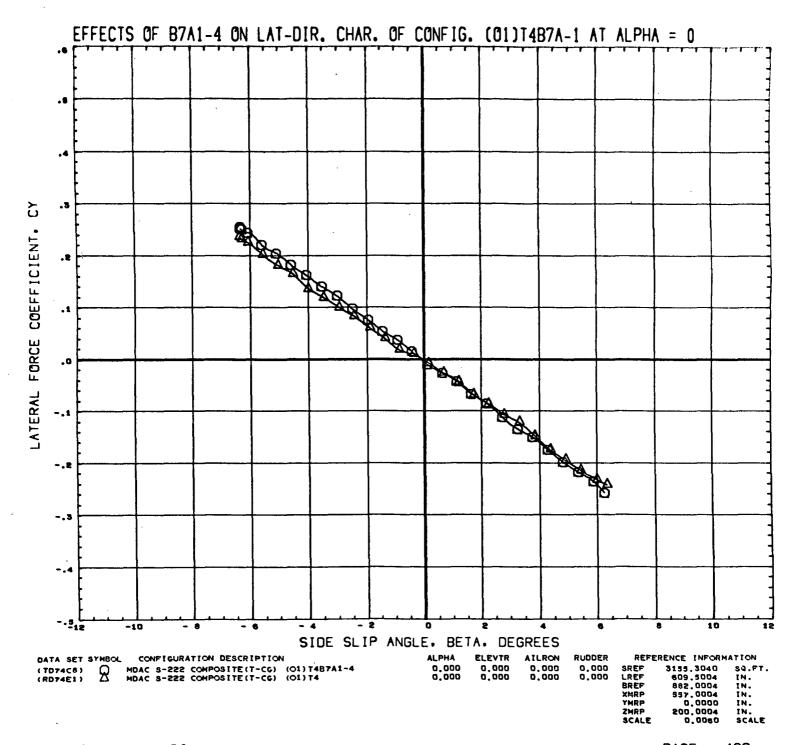


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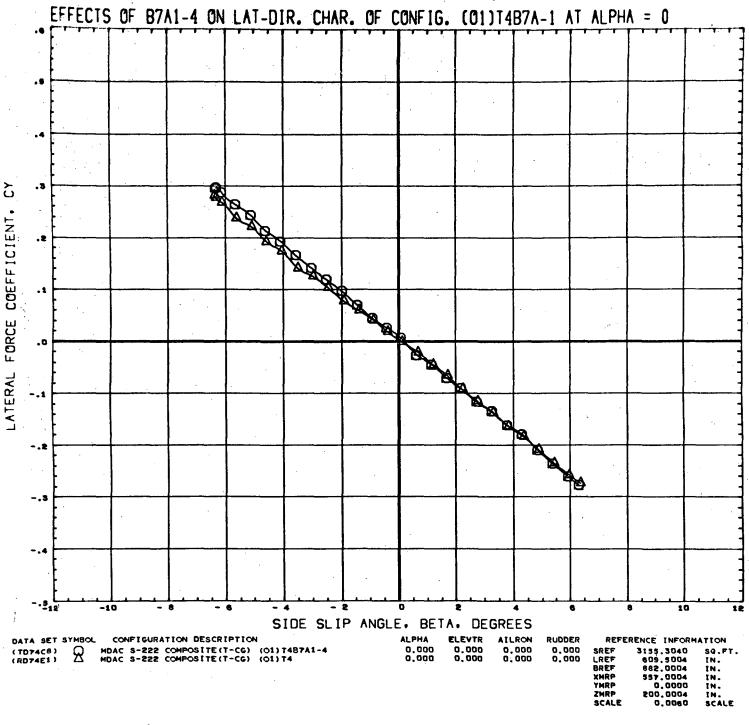


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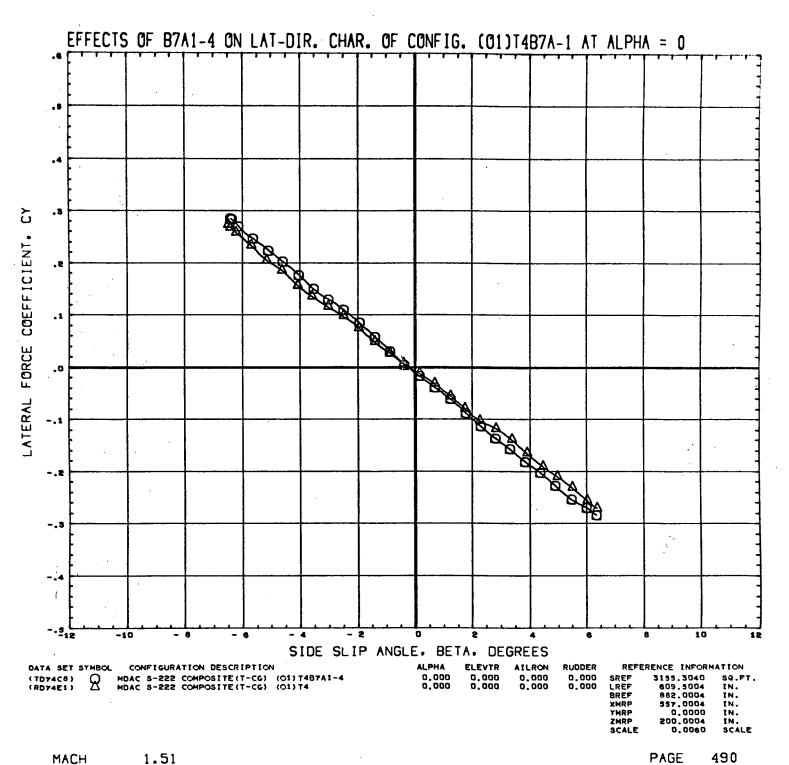


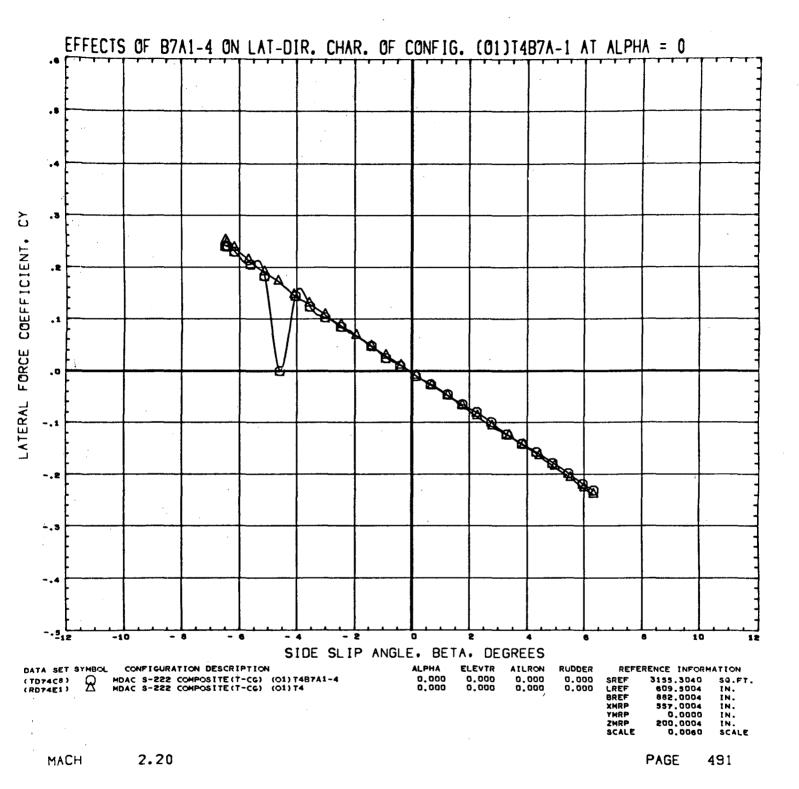
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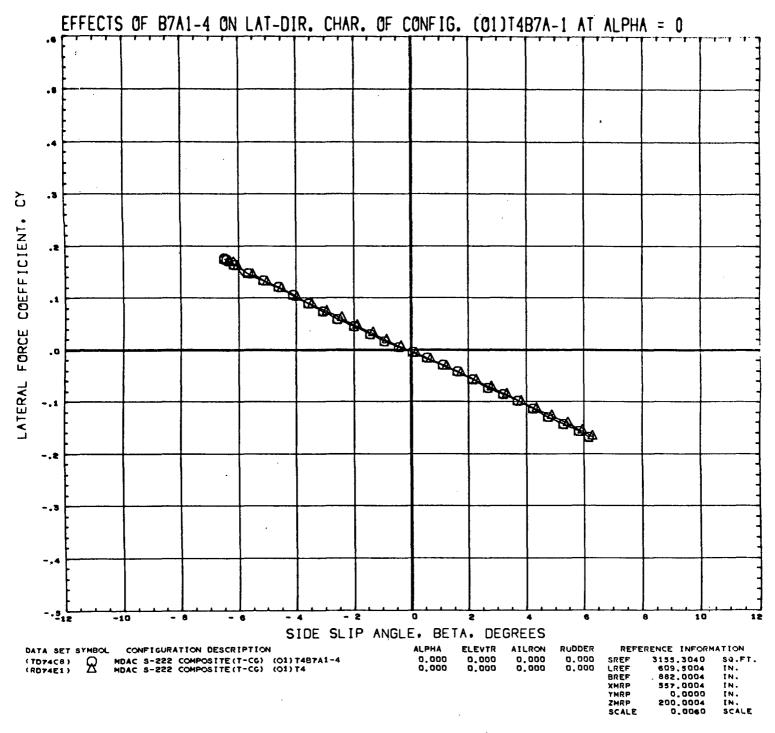
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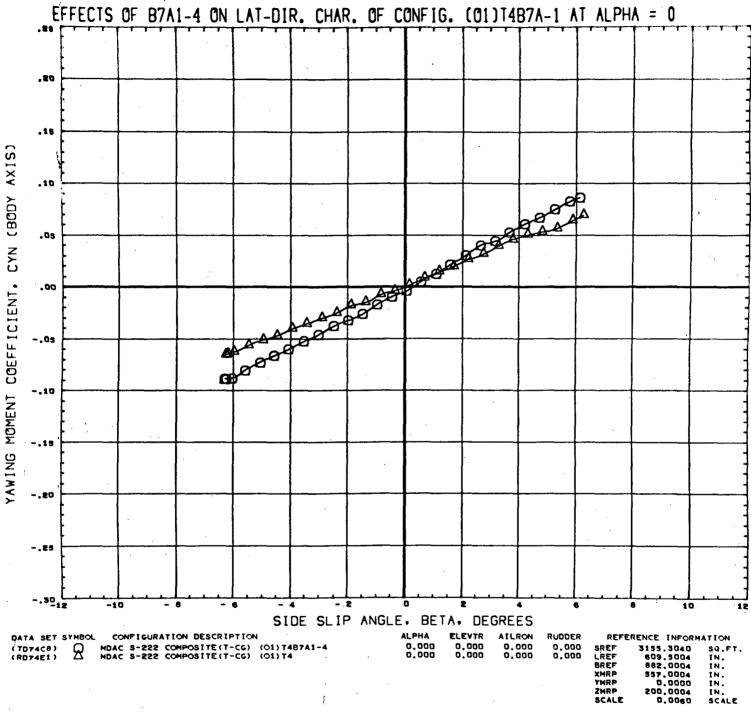
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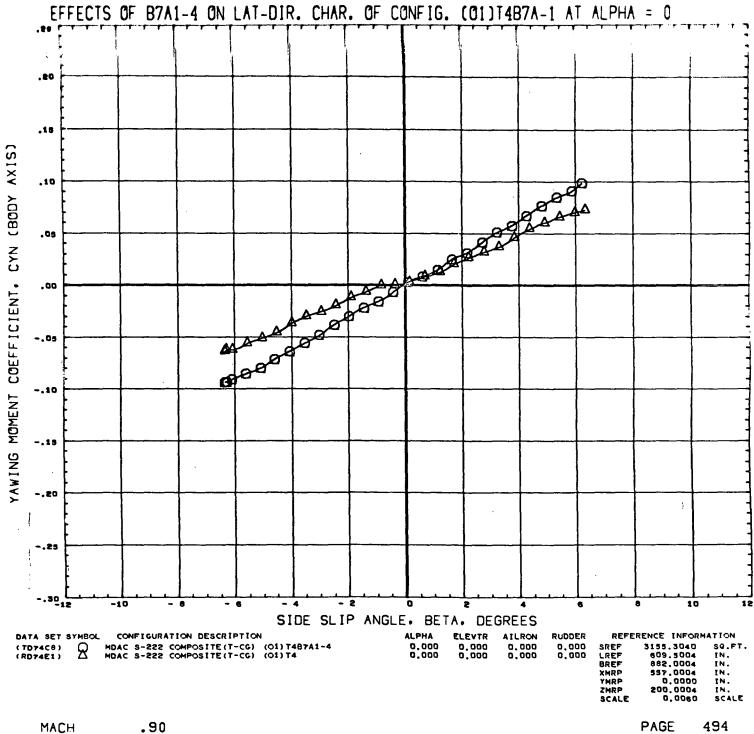


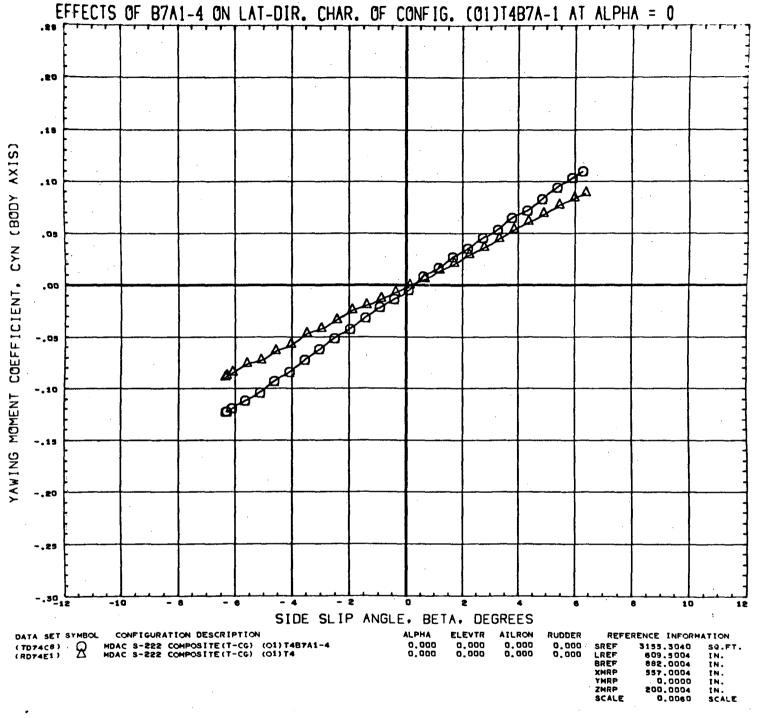


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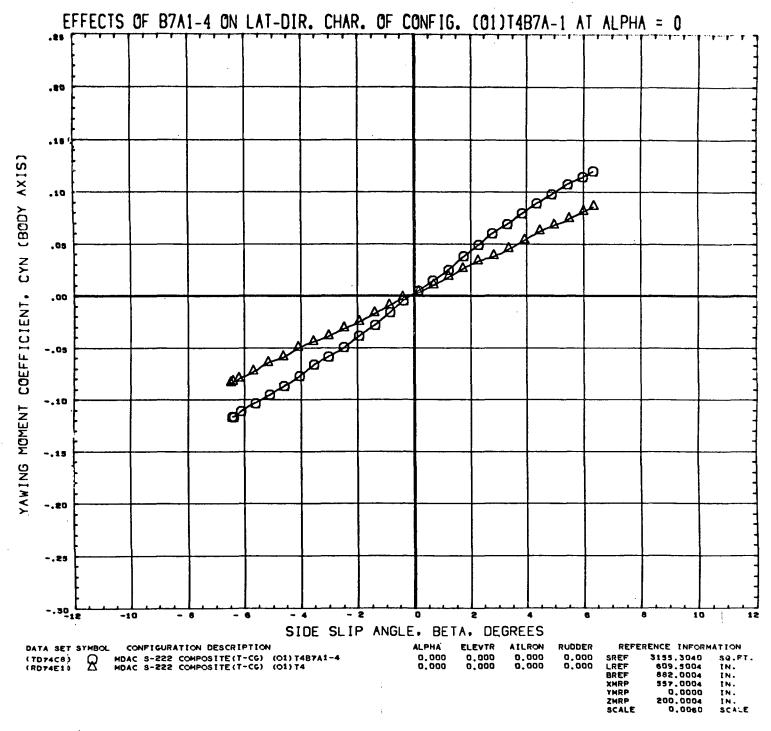


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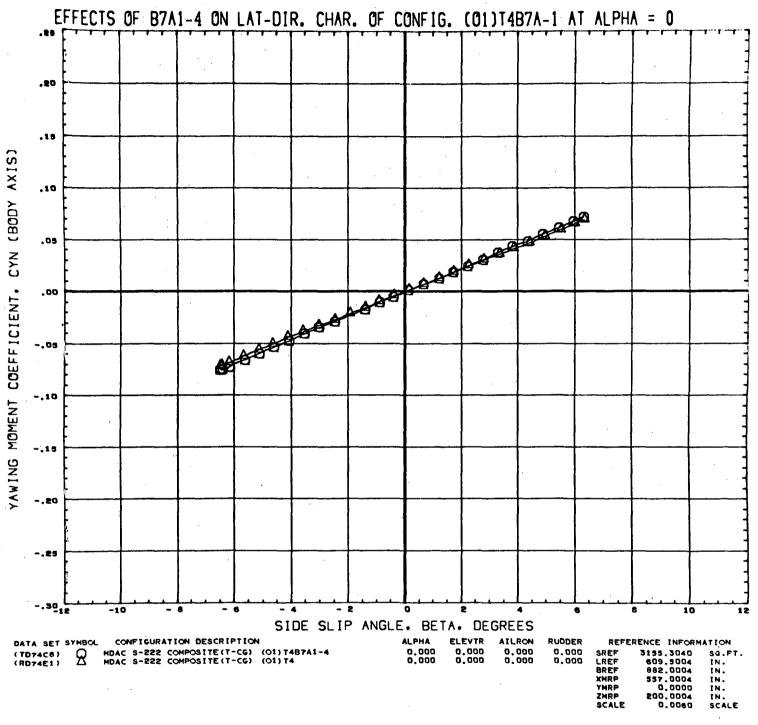




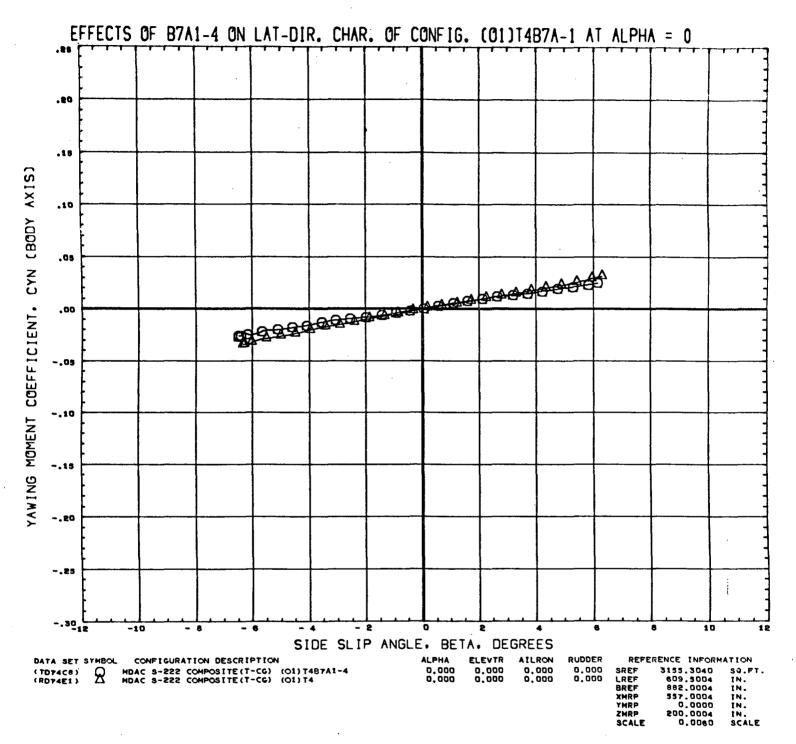
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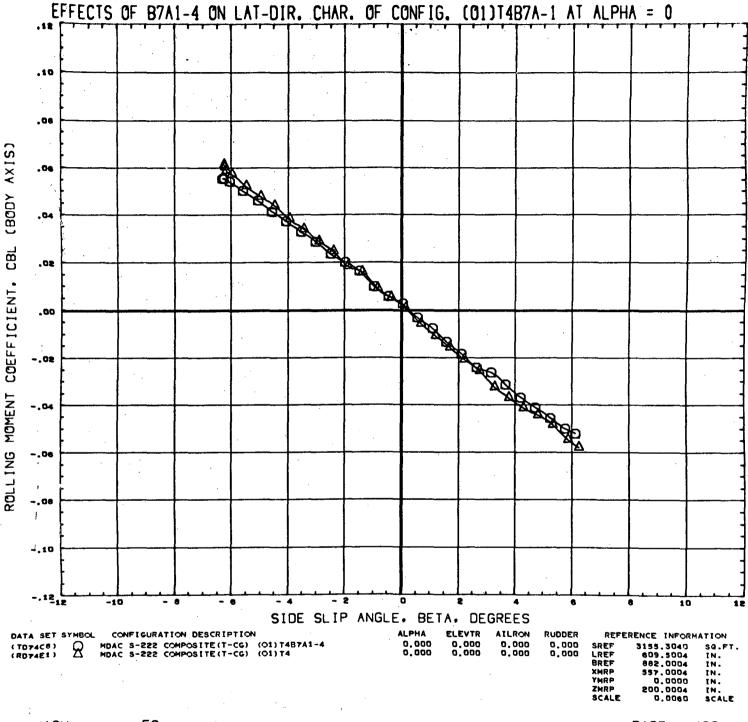
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MACH 2.20



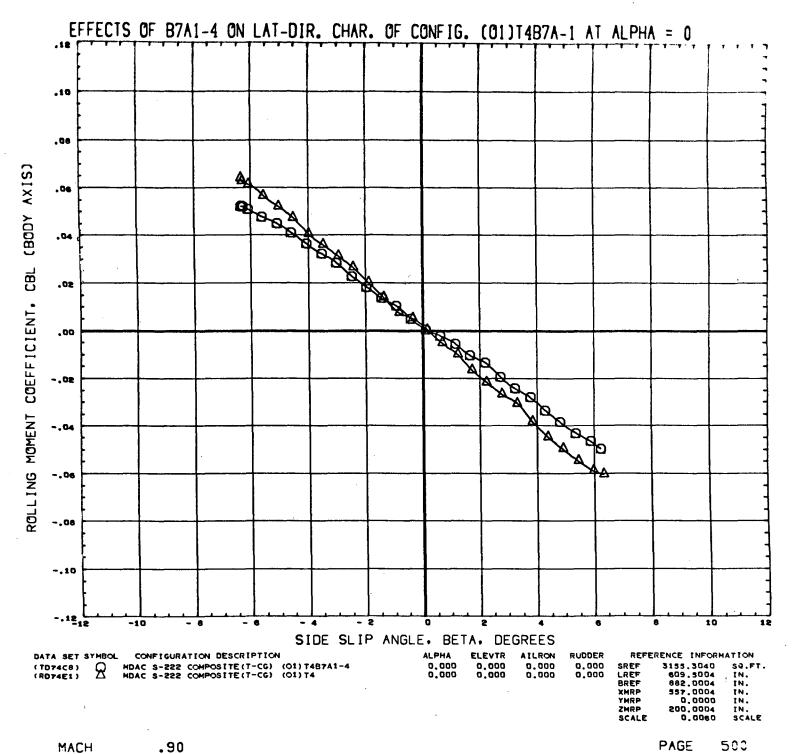
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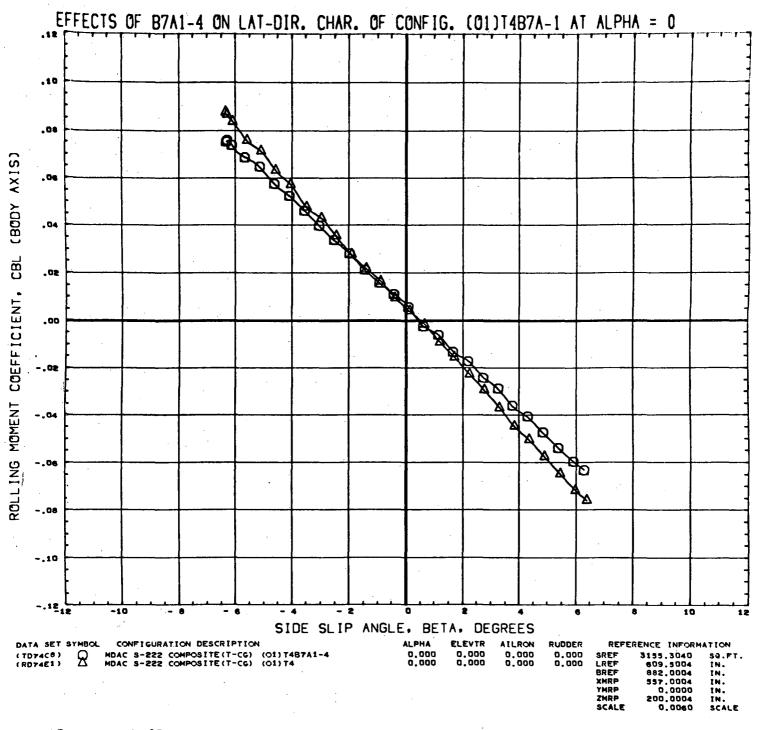


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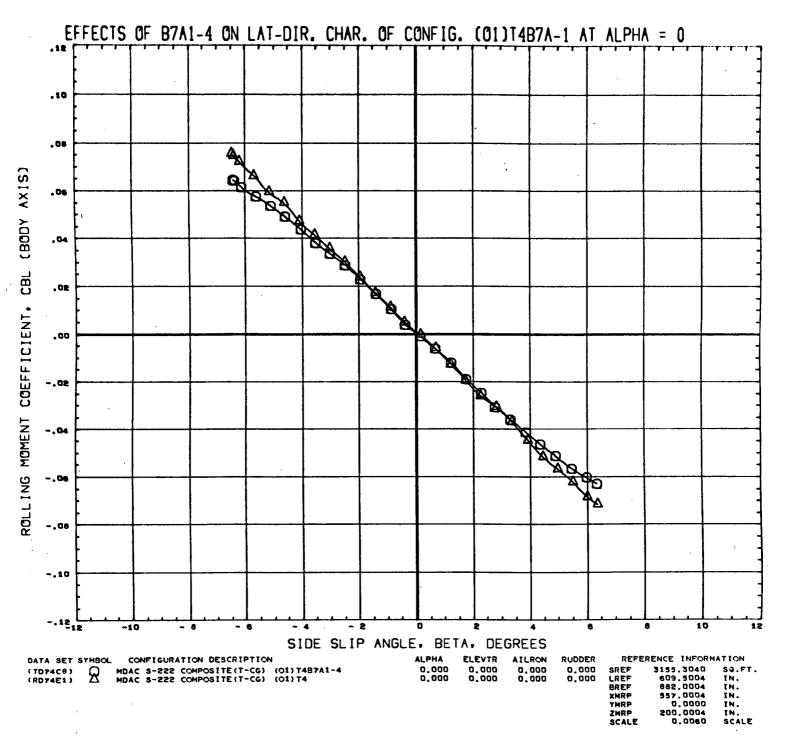
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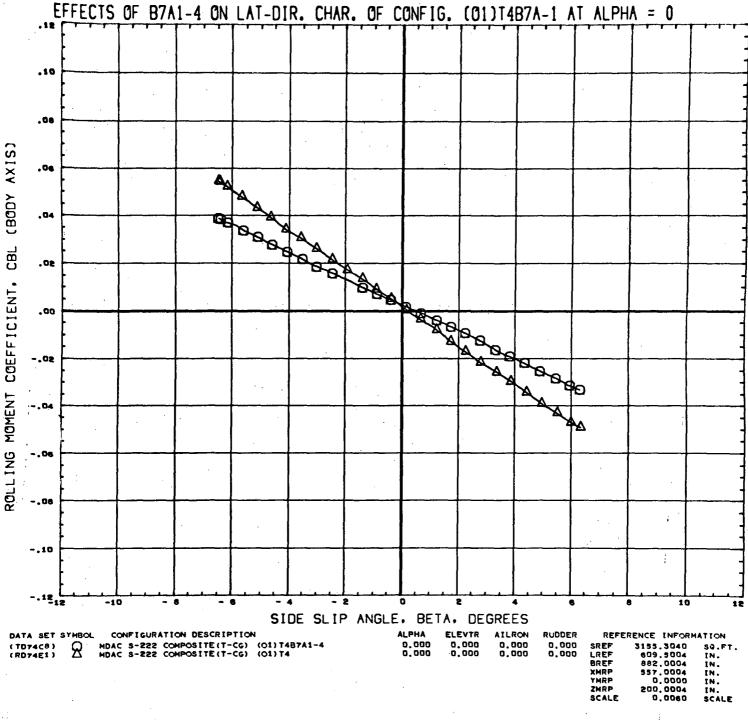




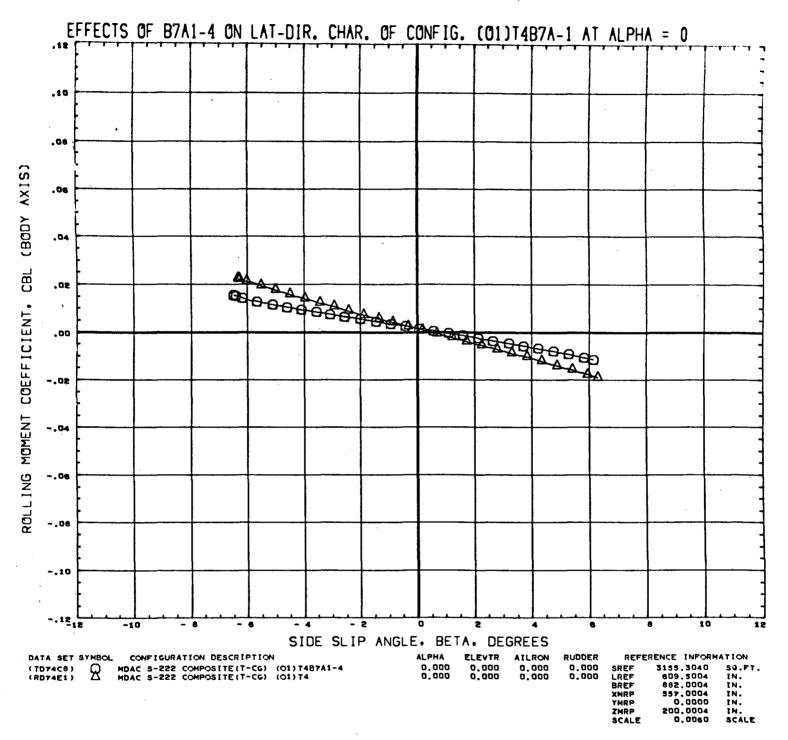
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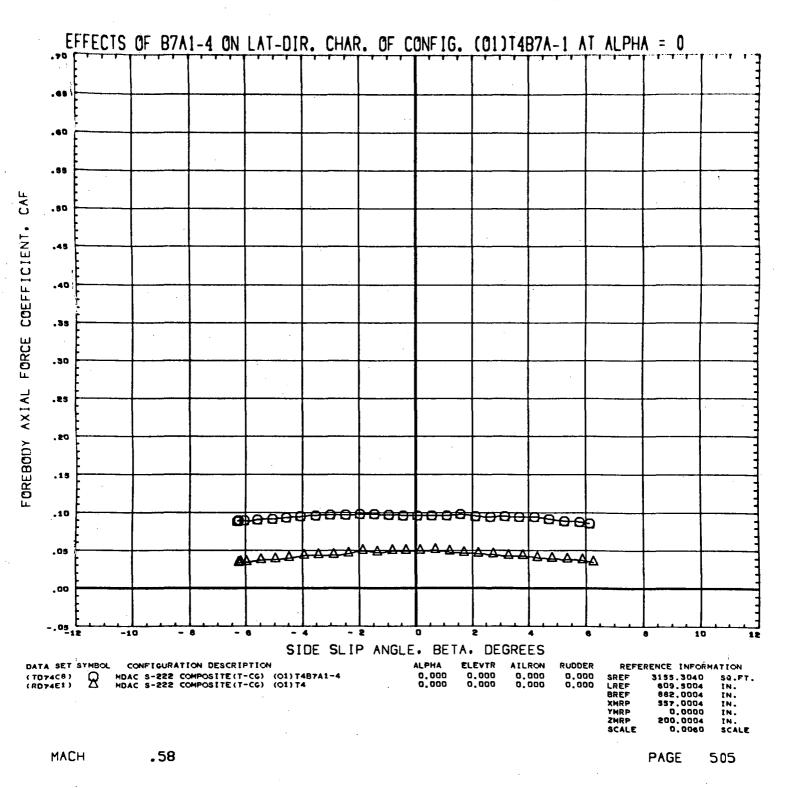


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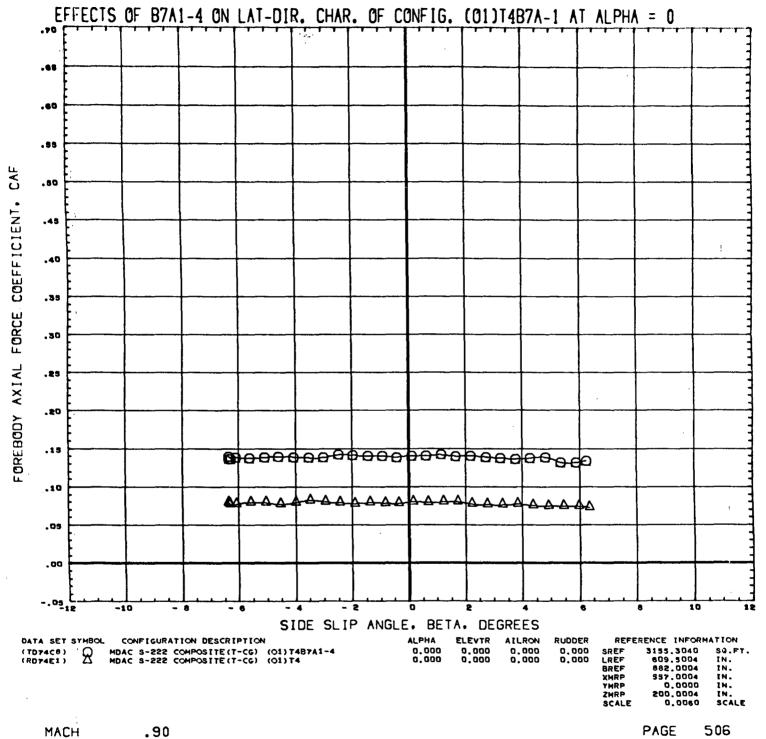


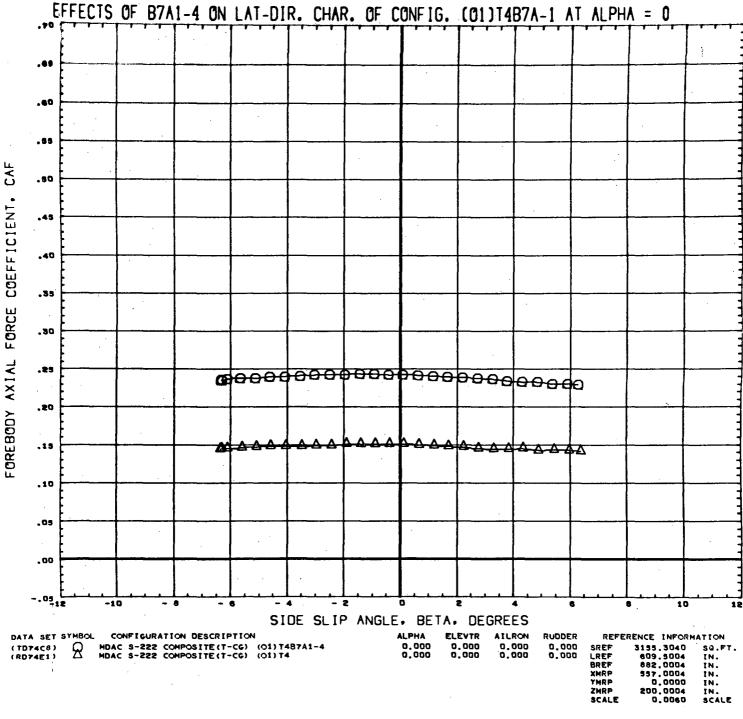
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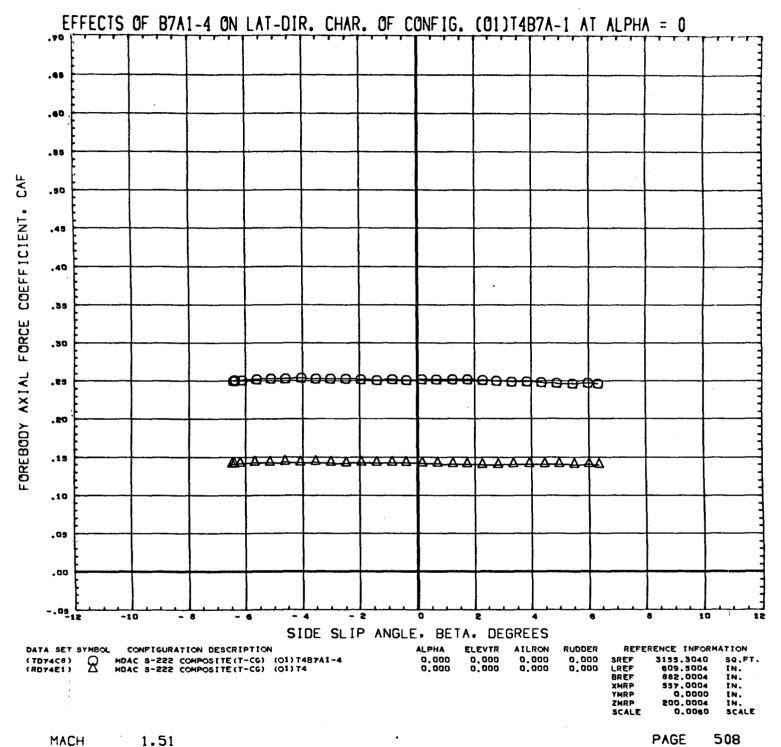


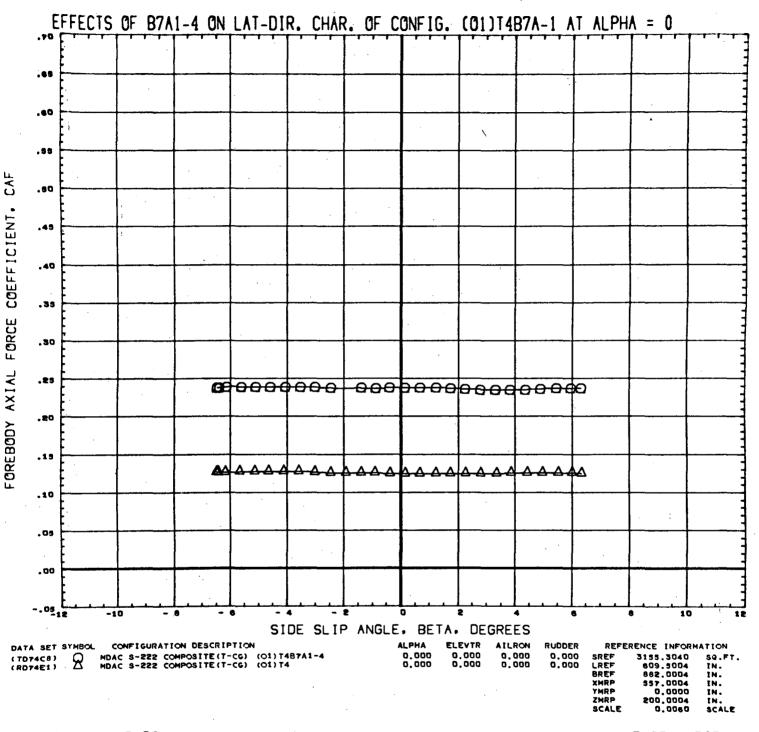
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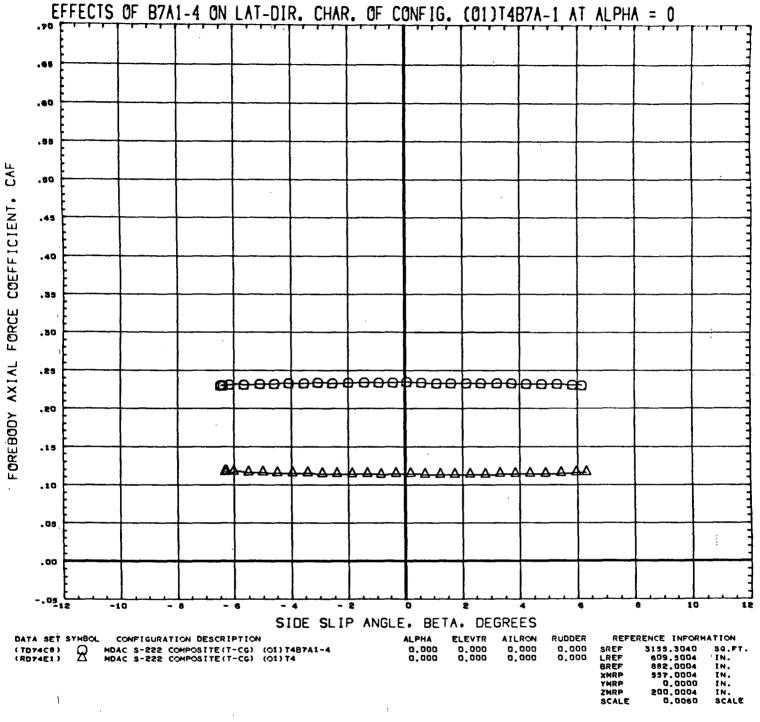


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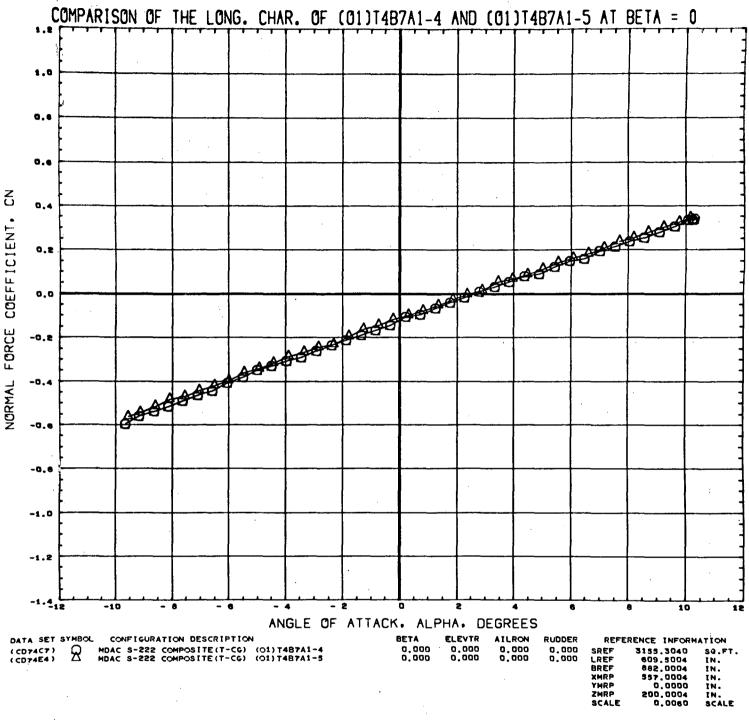


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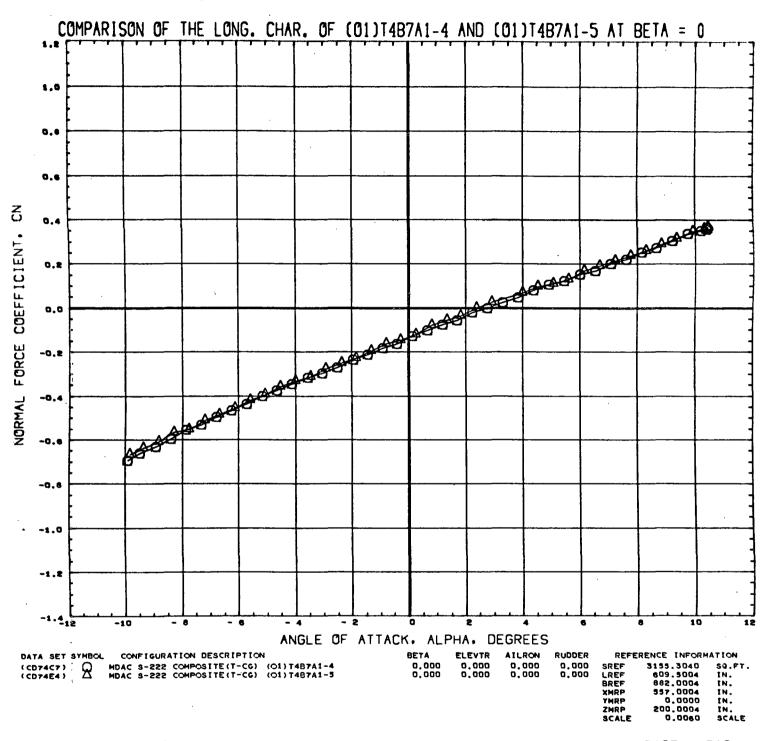


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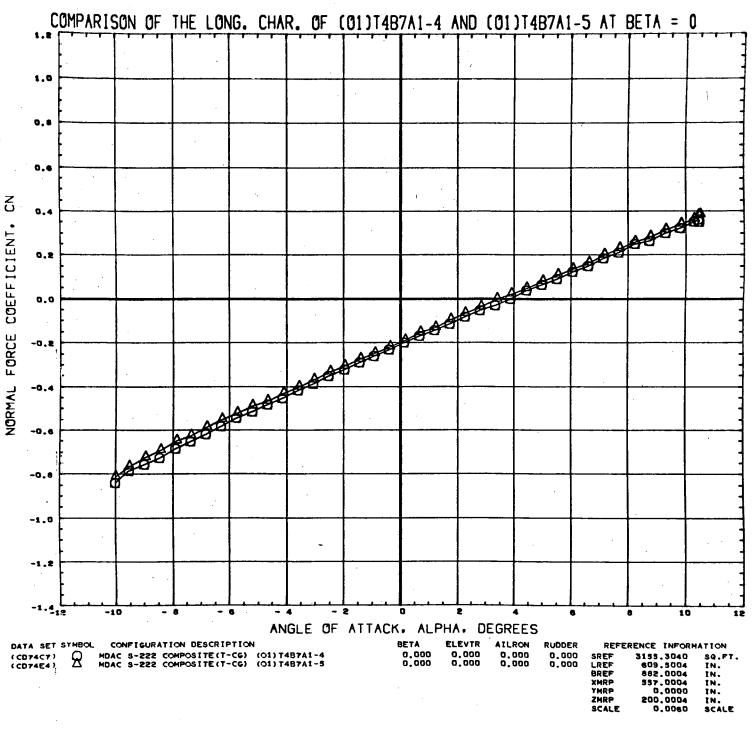
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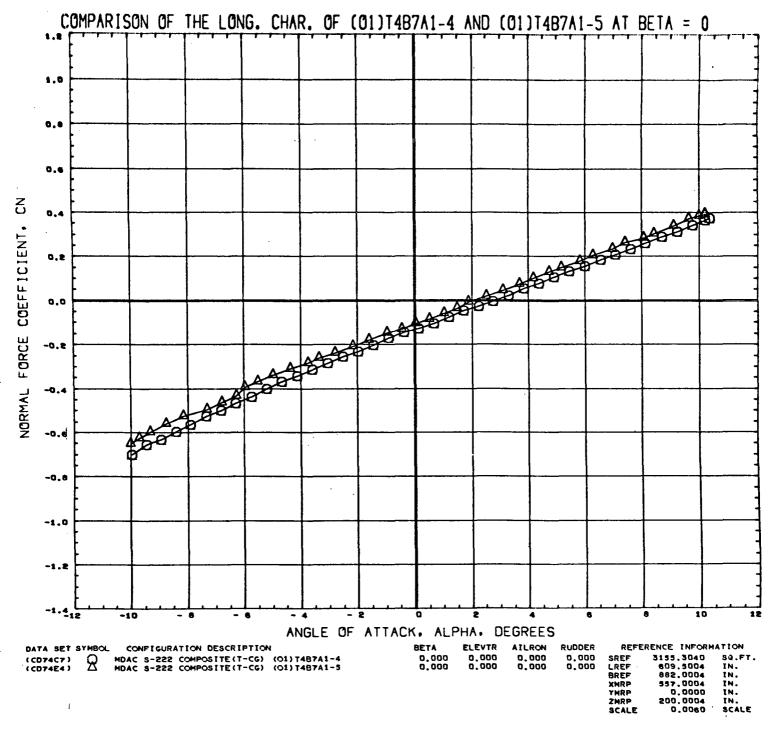
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MACH .90

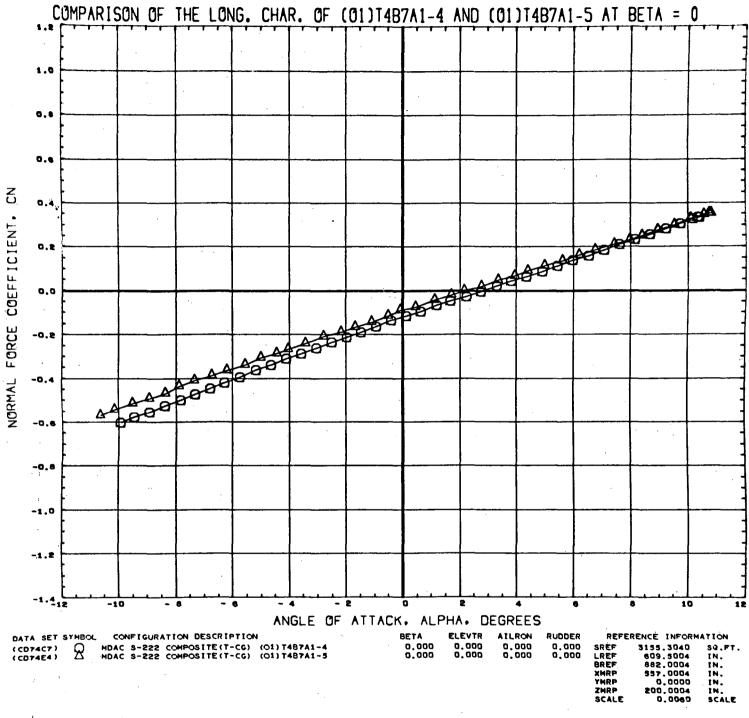


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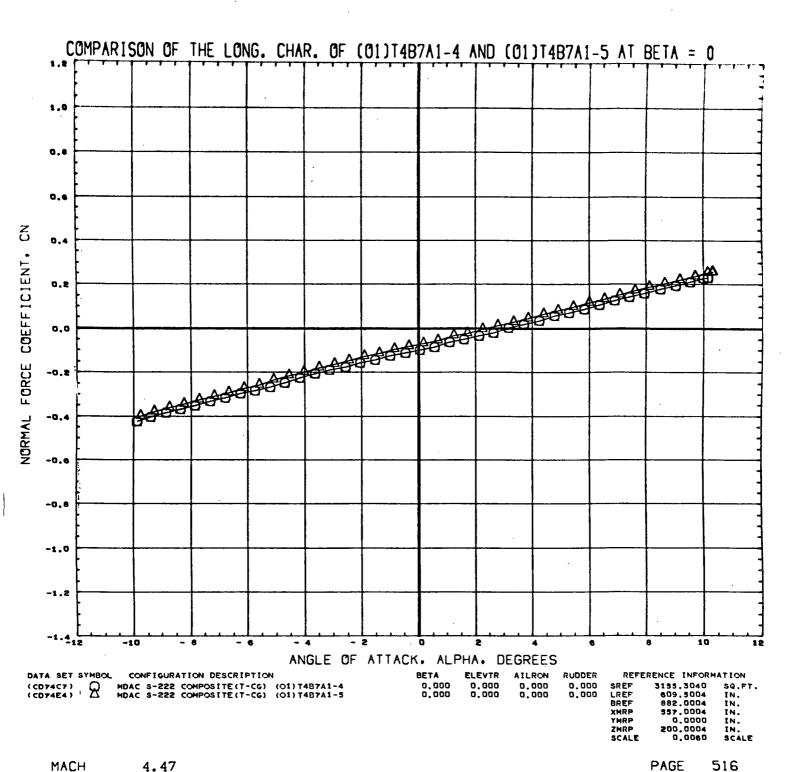


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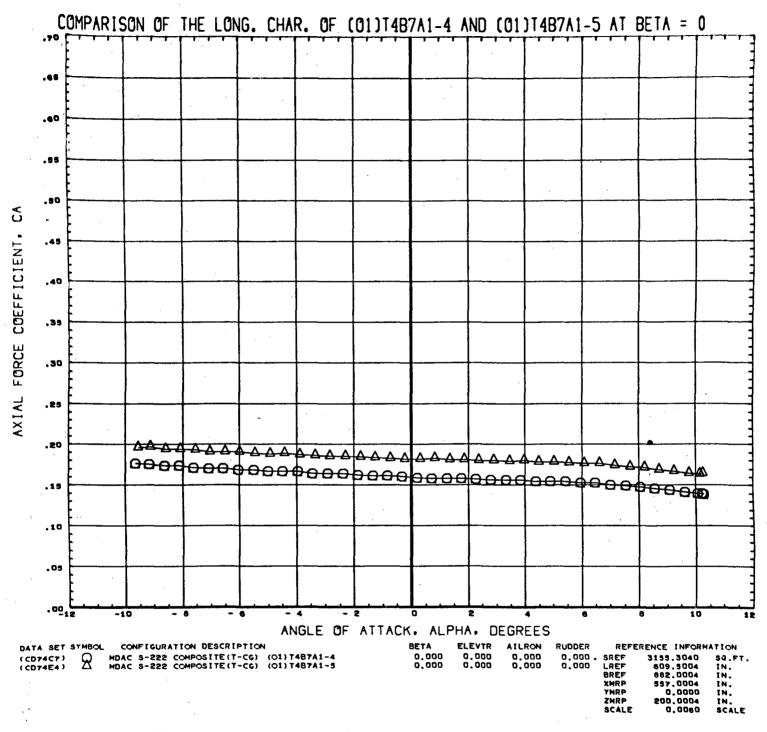
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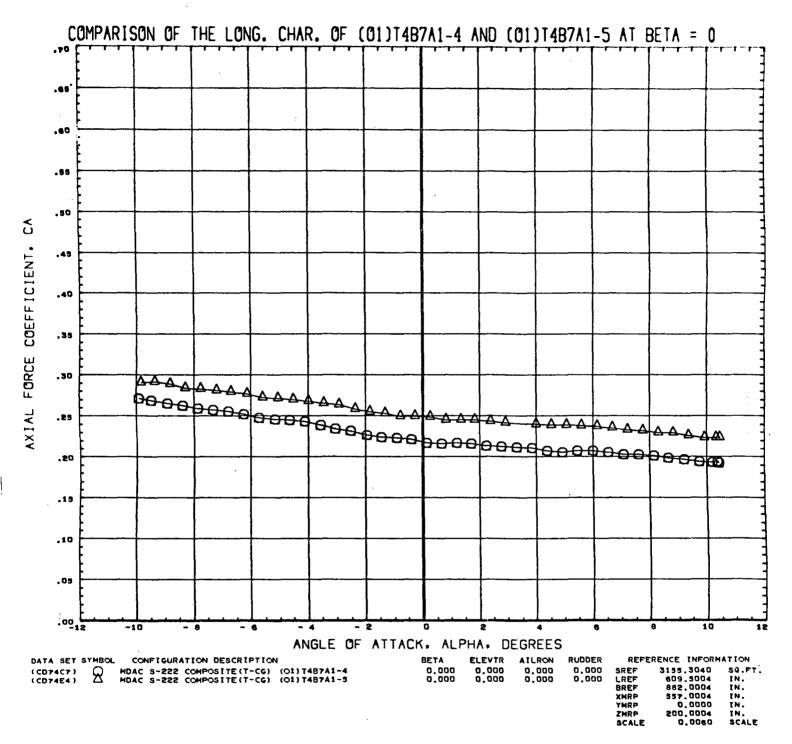
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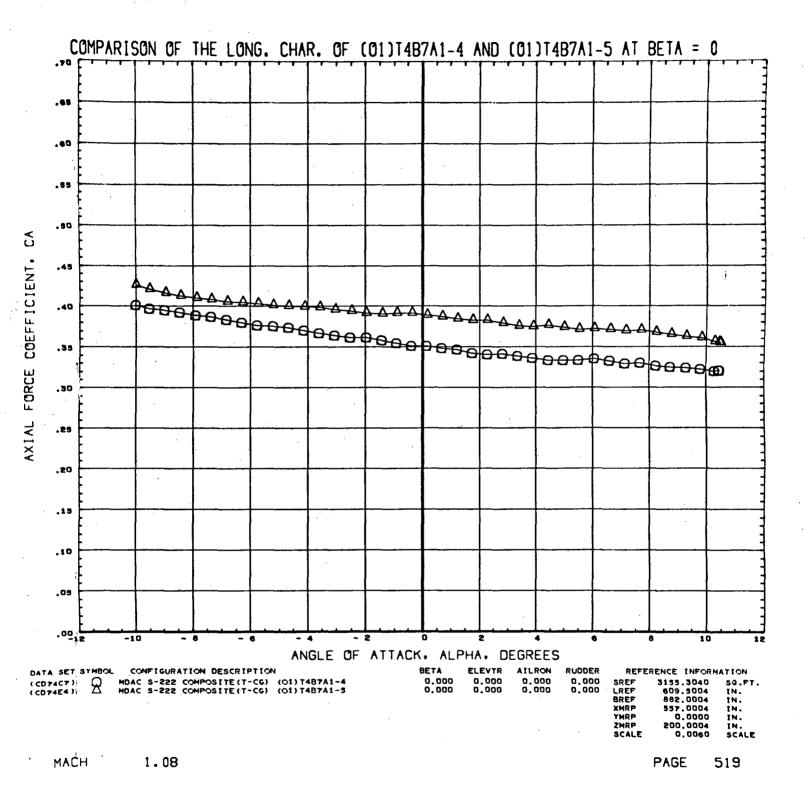


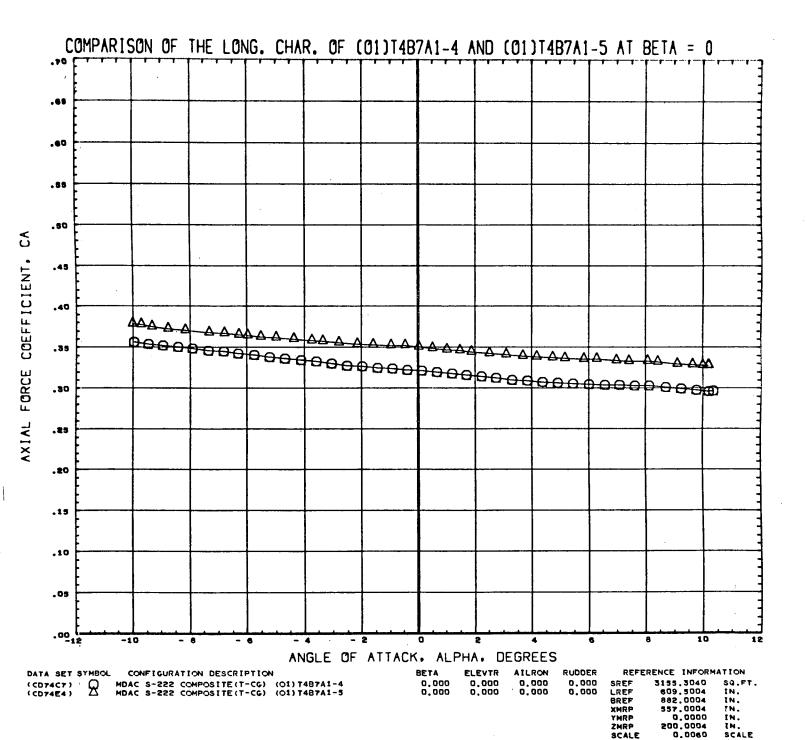
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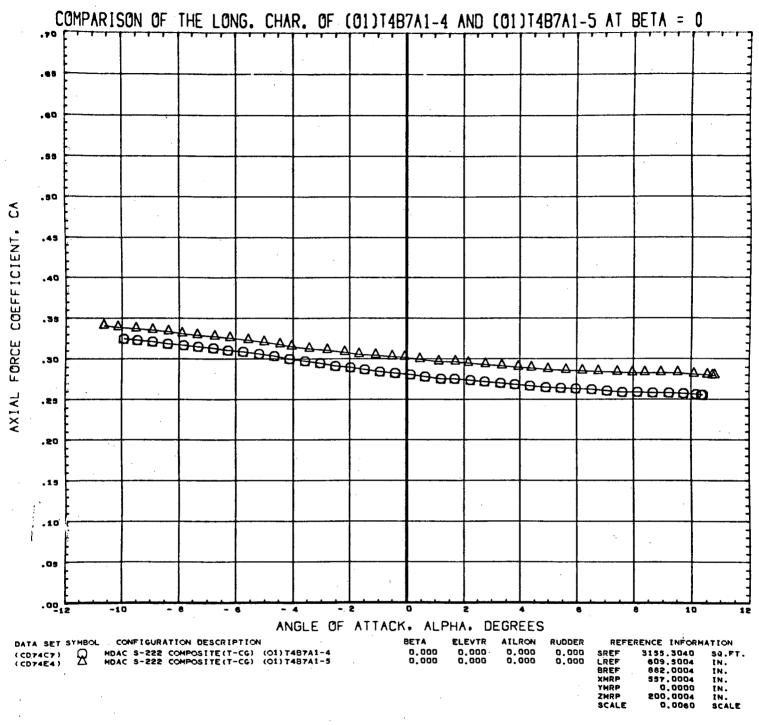


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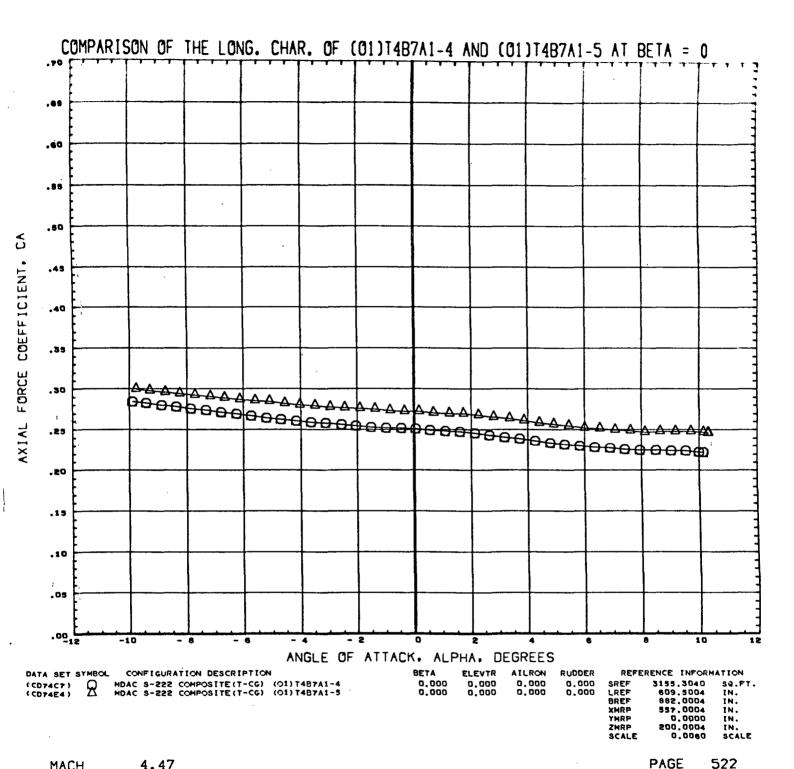
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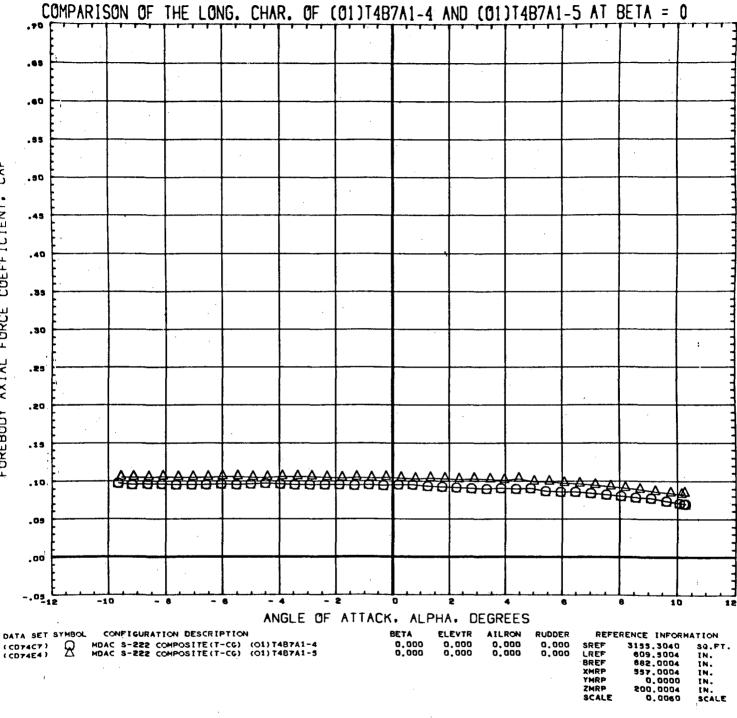


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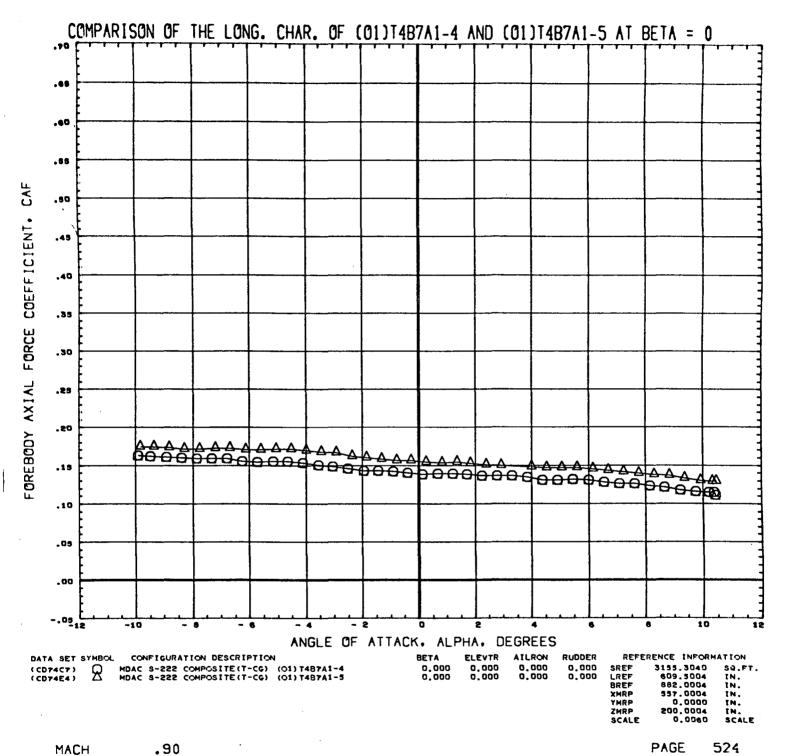
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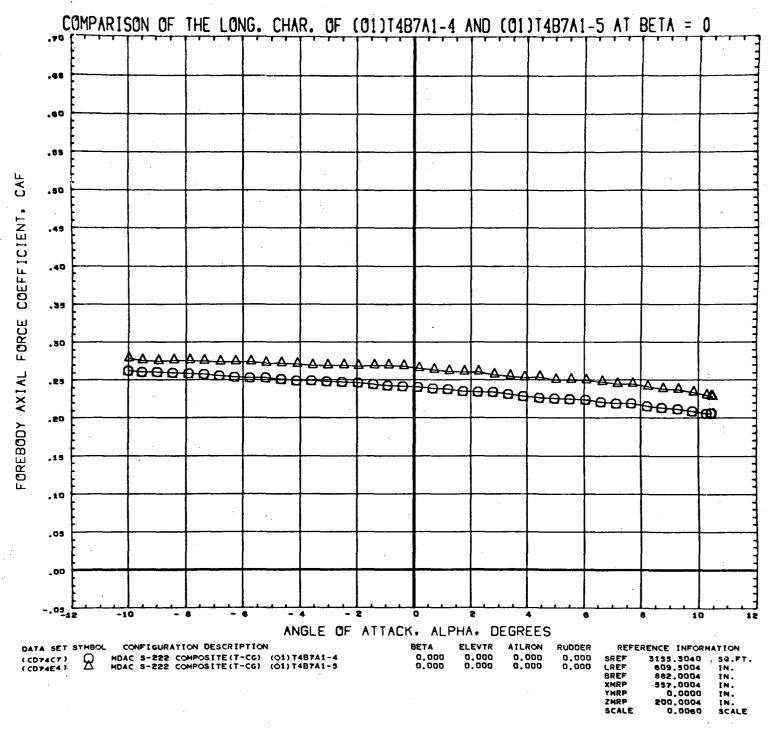


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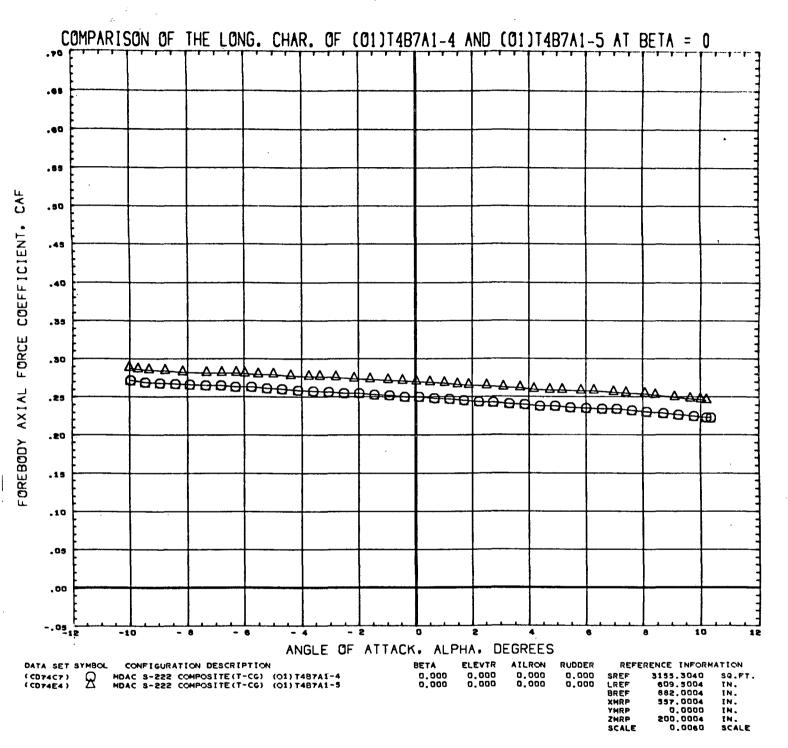
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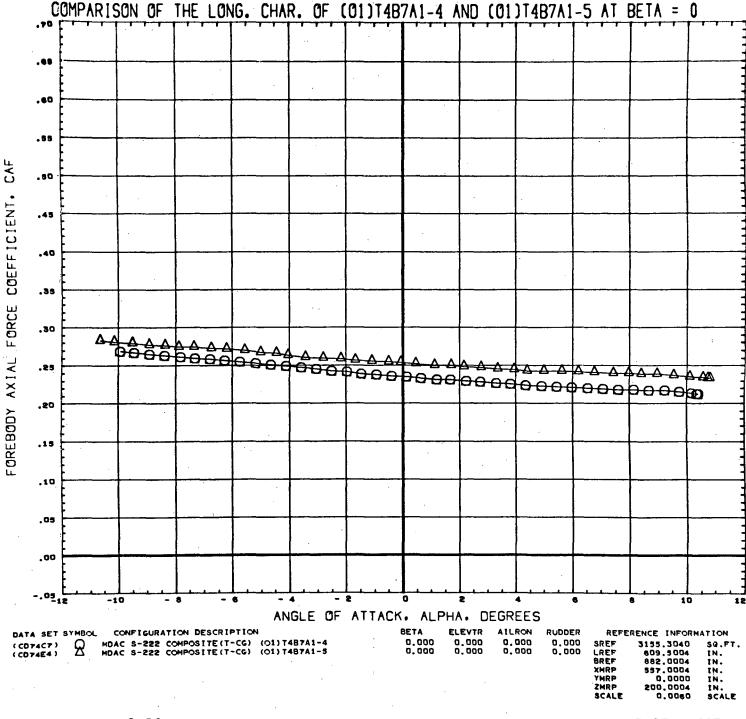


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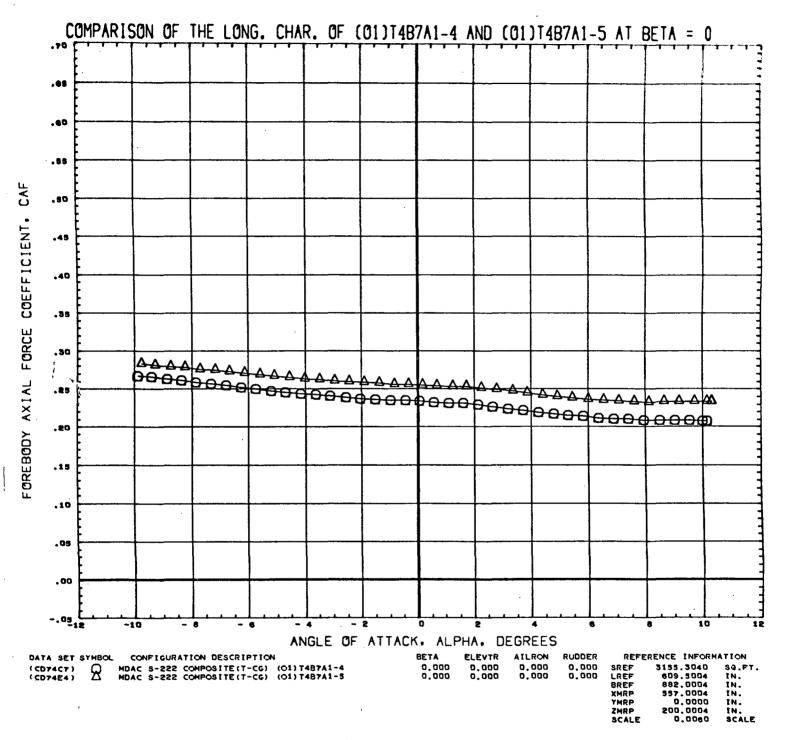


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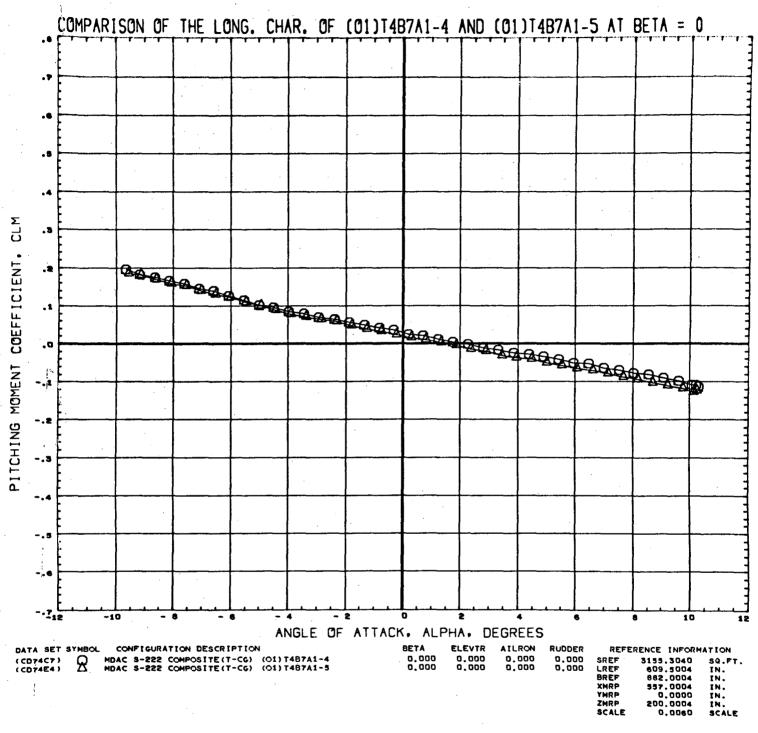


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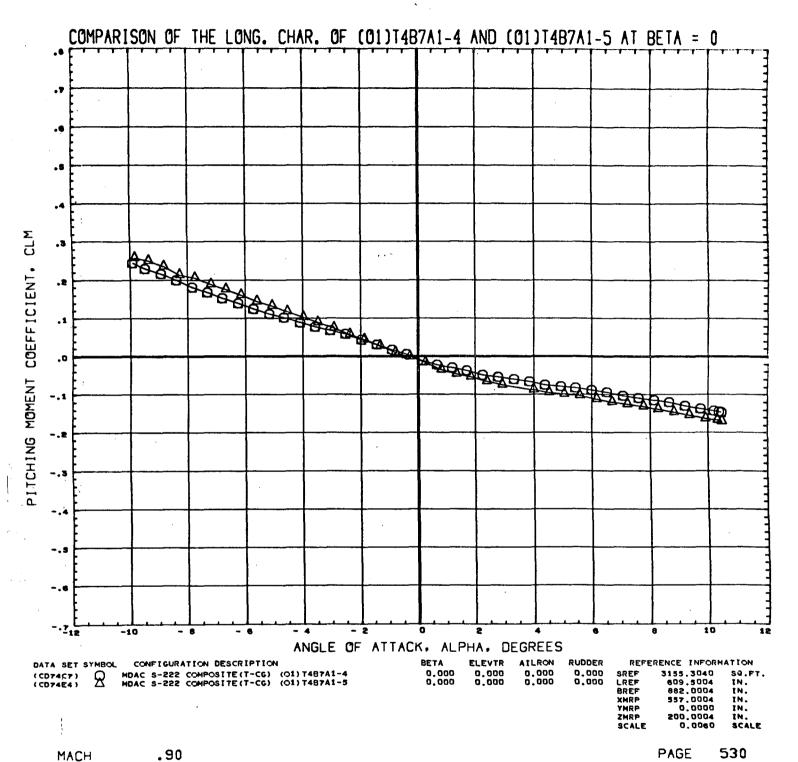


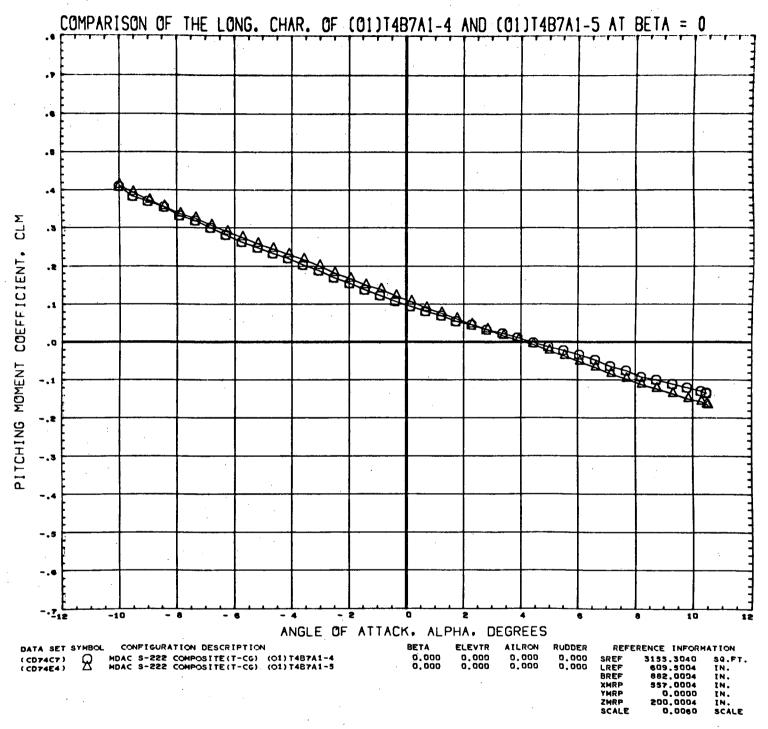
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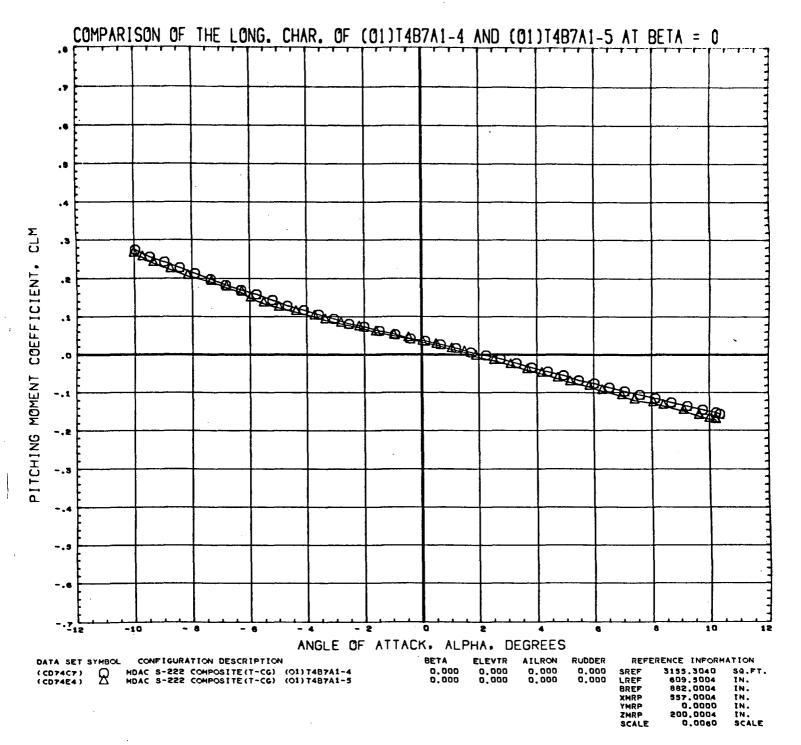


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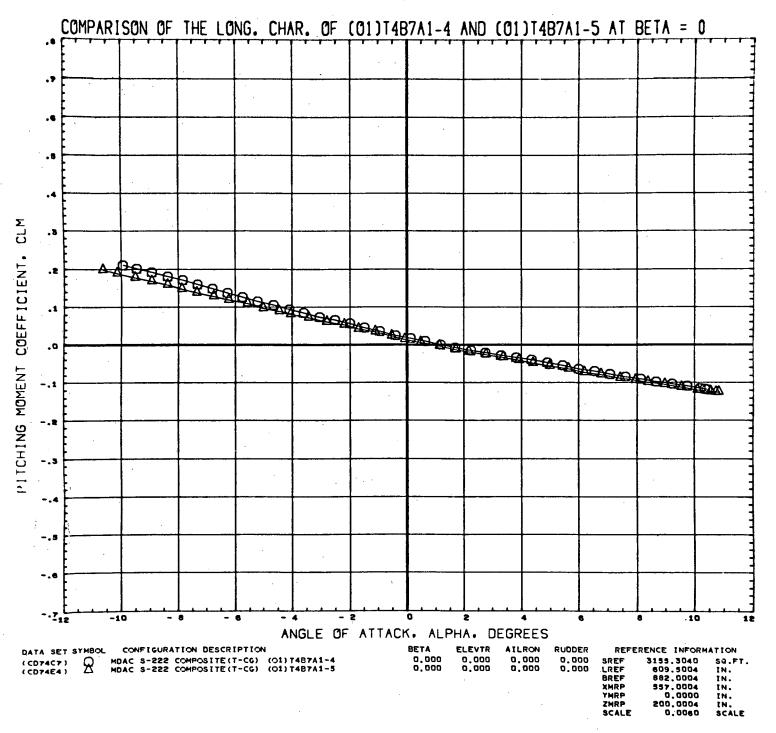




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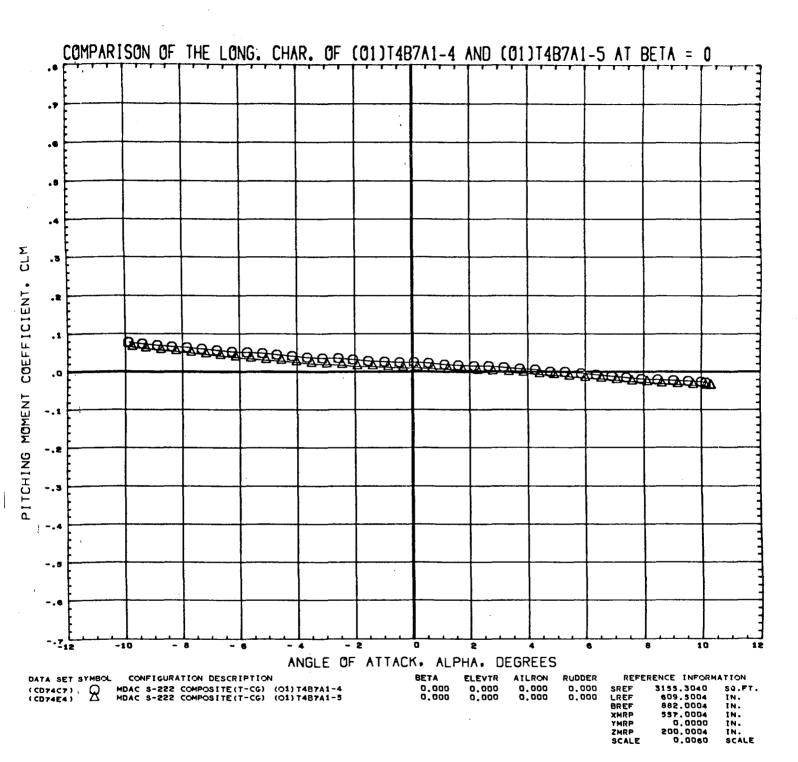
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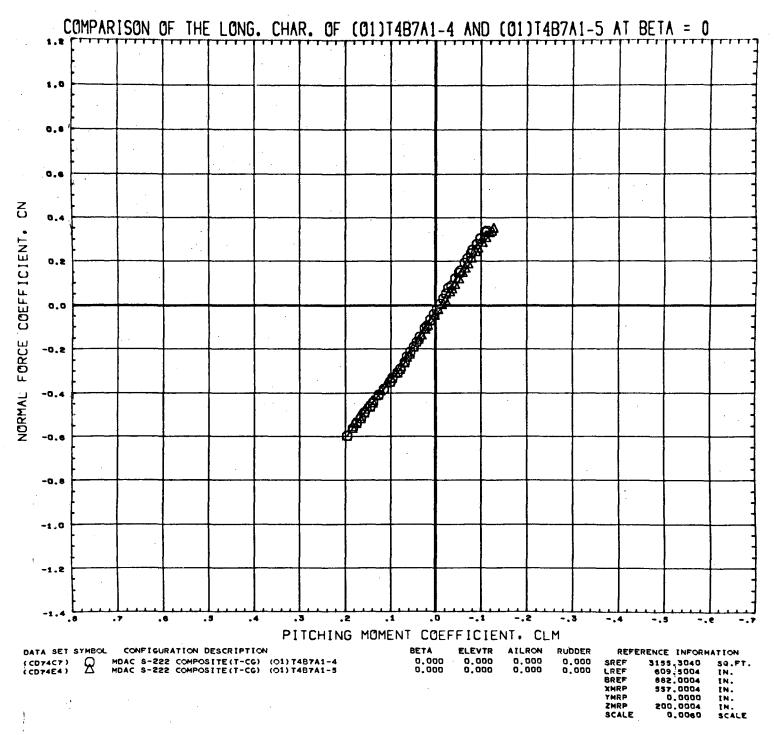
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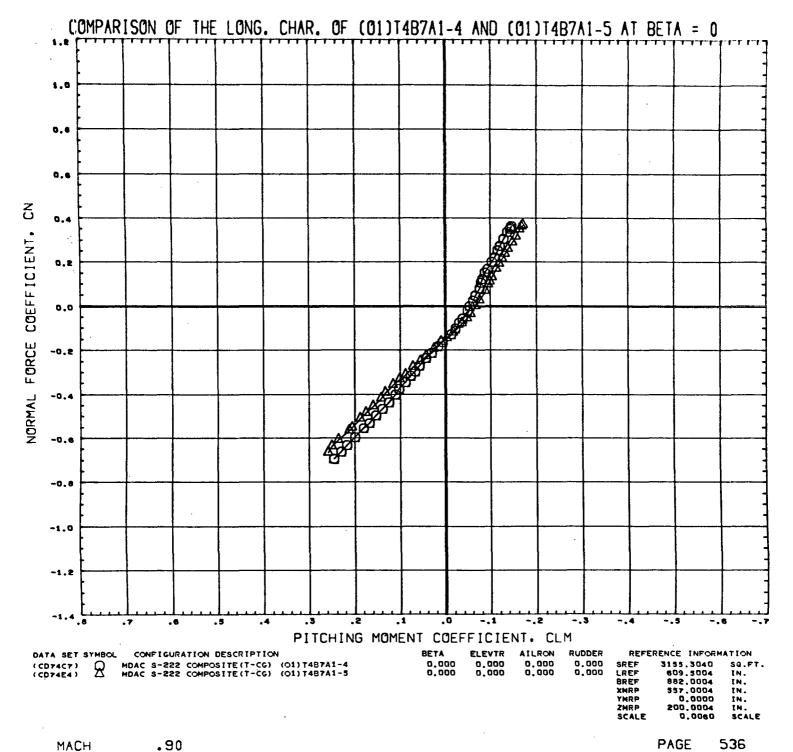
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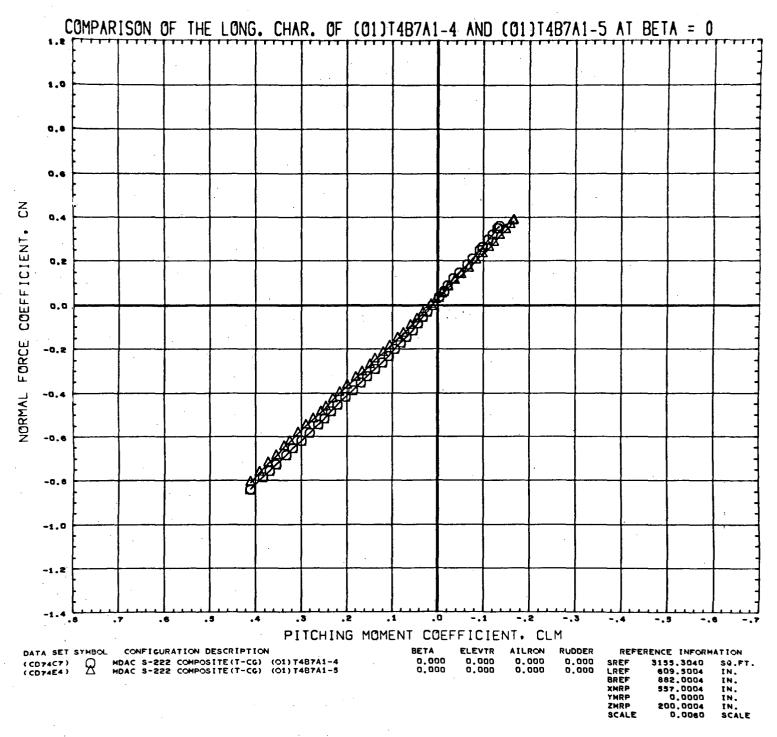


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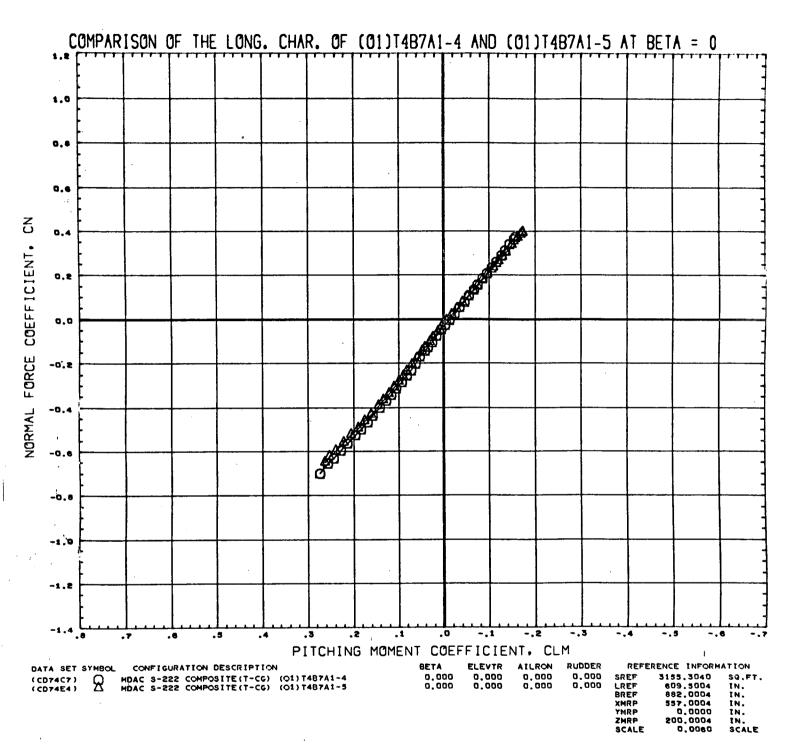


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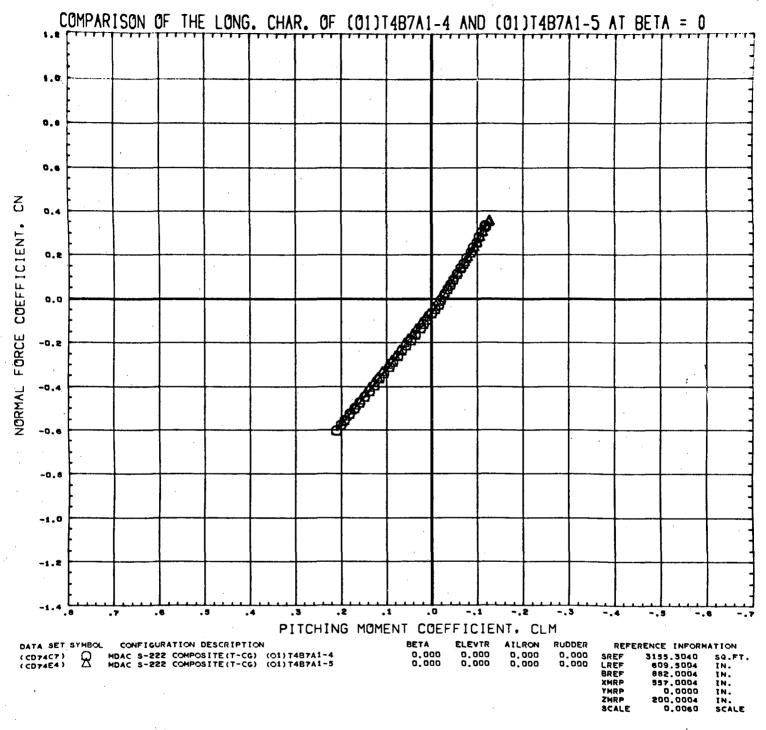


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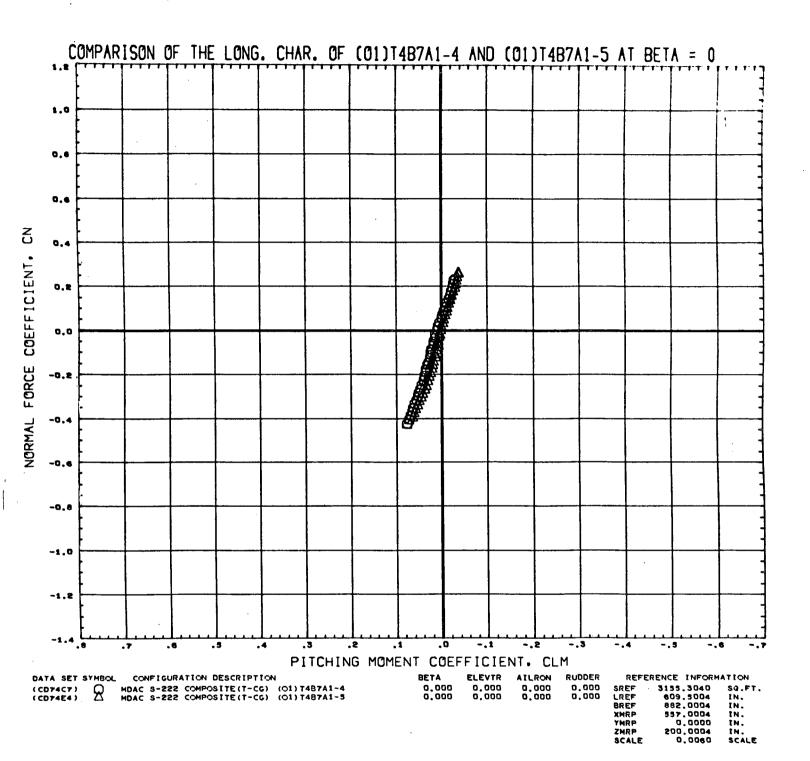


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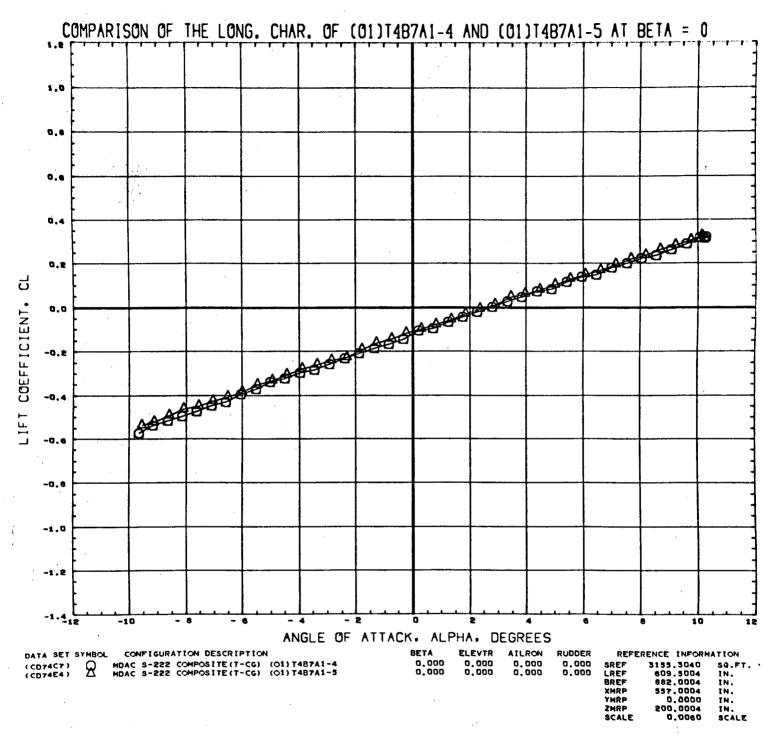
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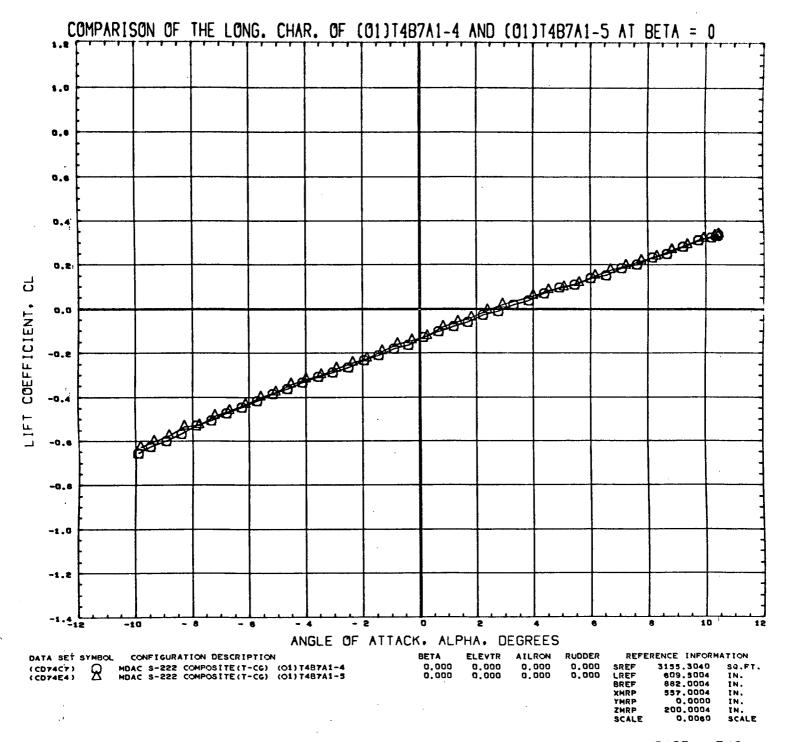


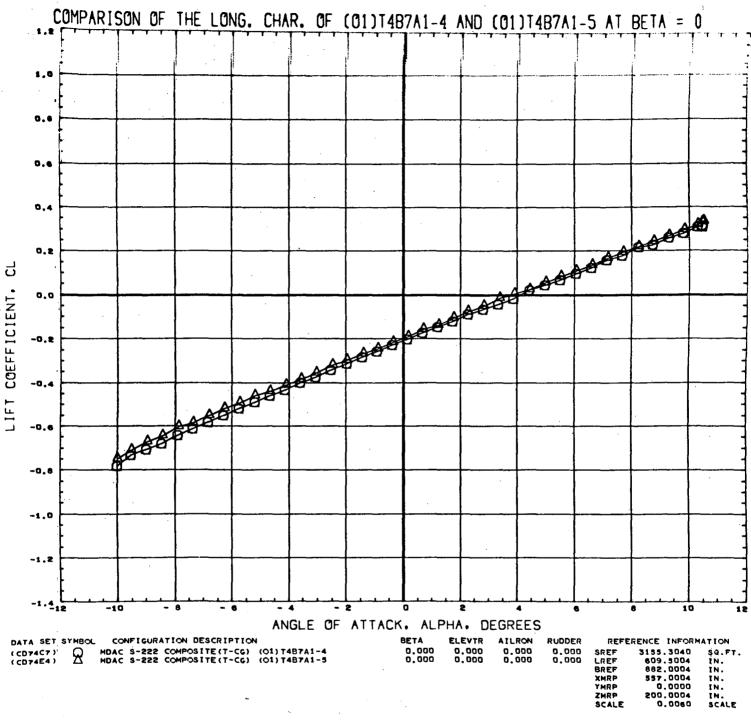
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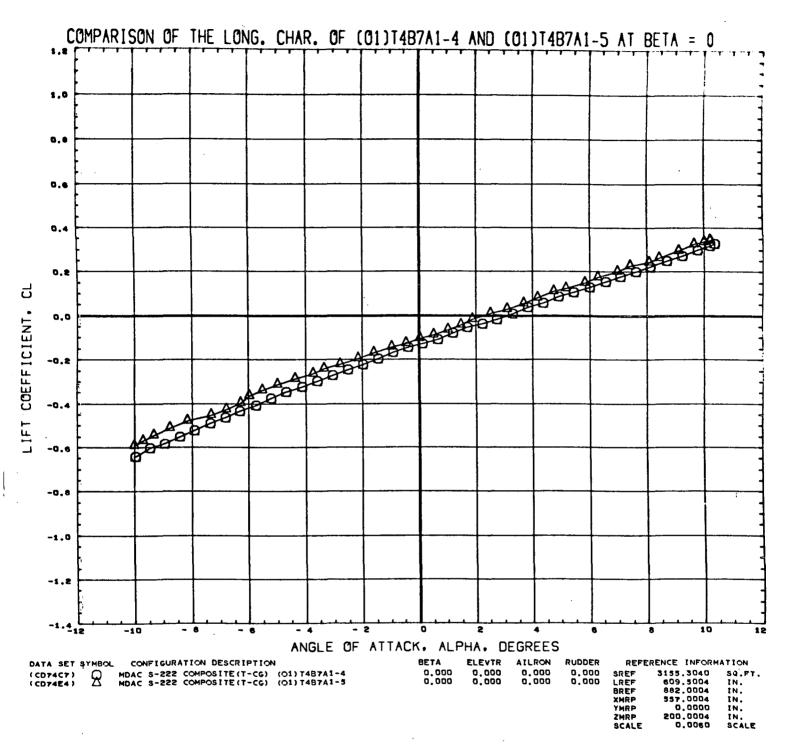
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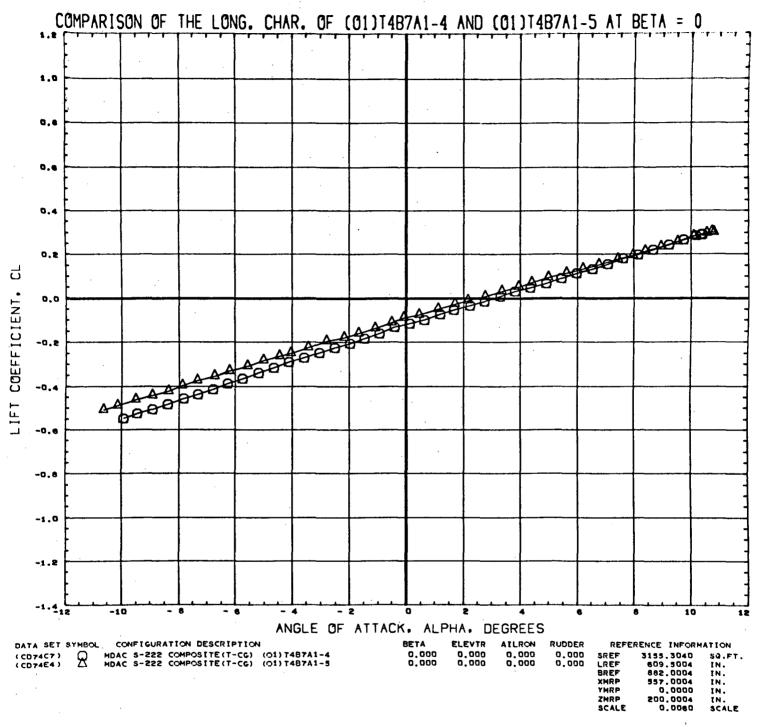


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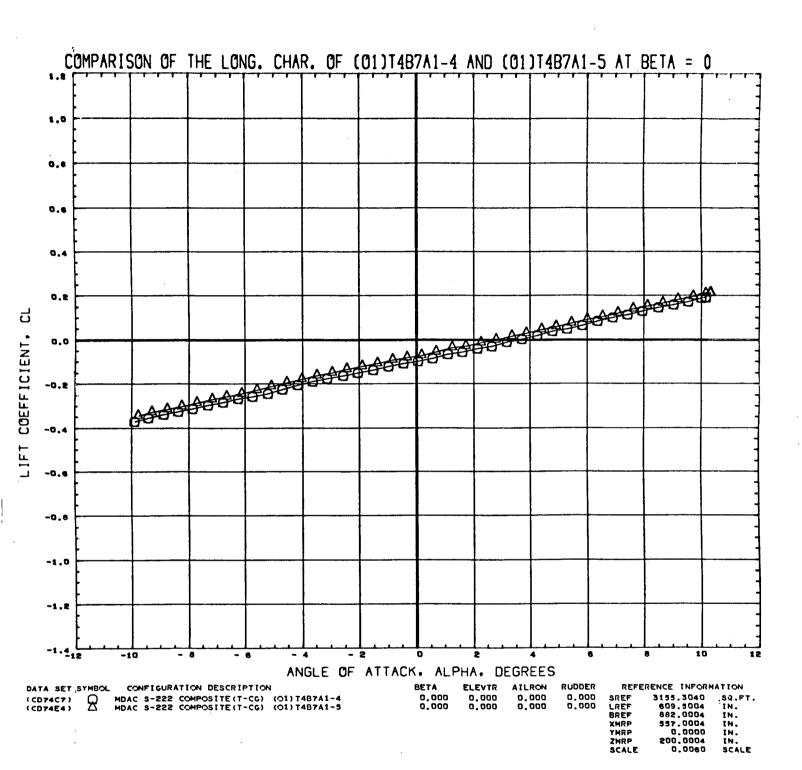


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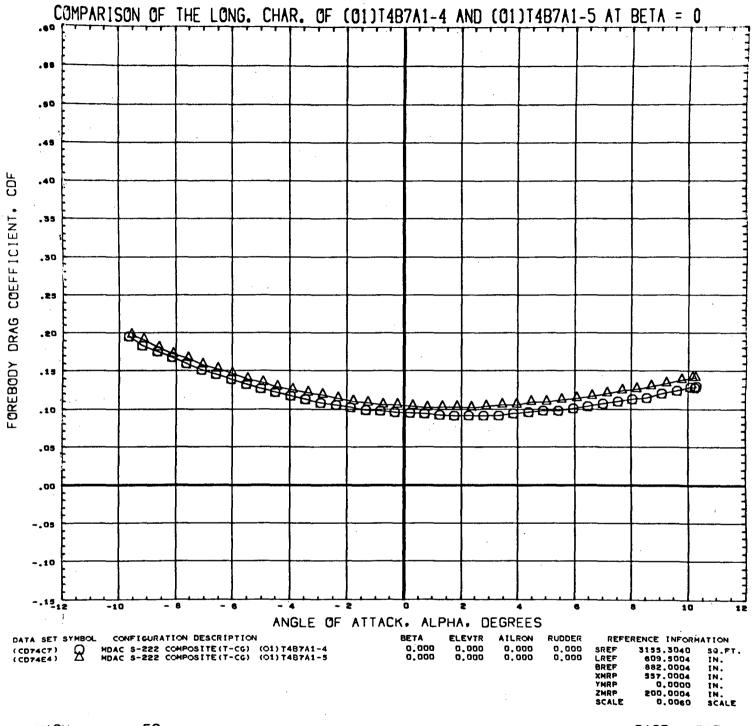


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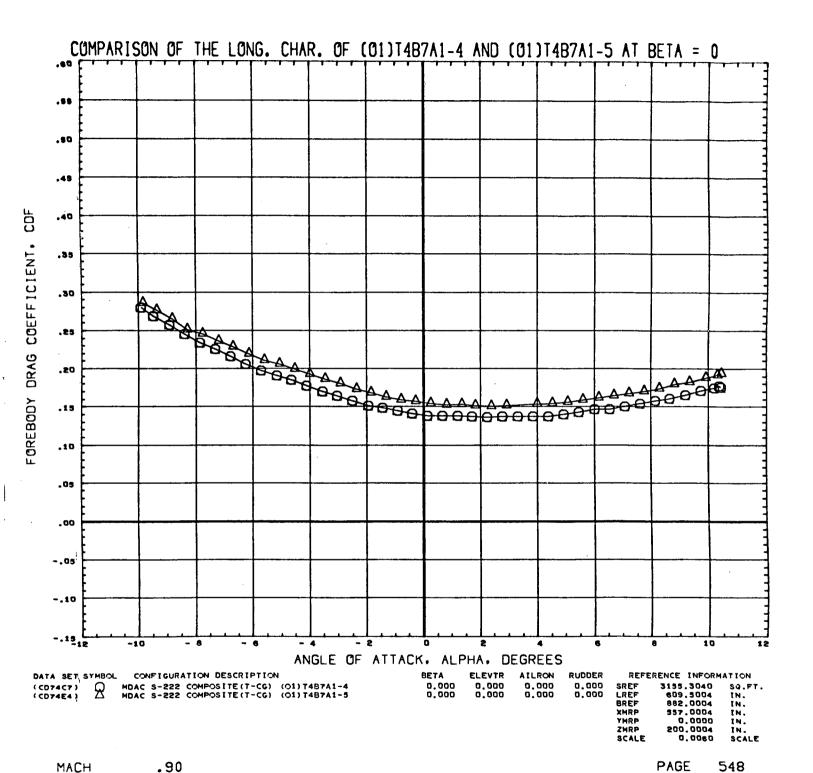
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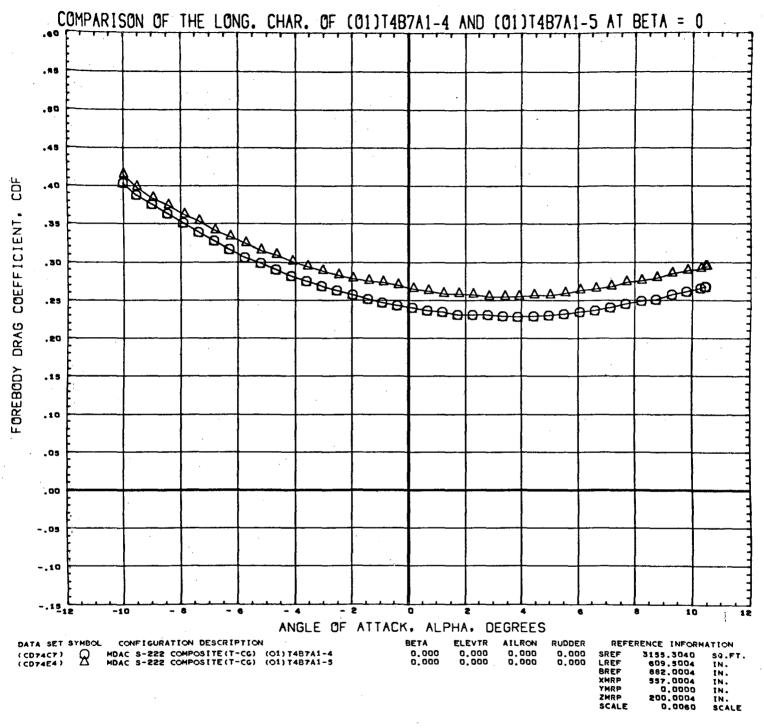
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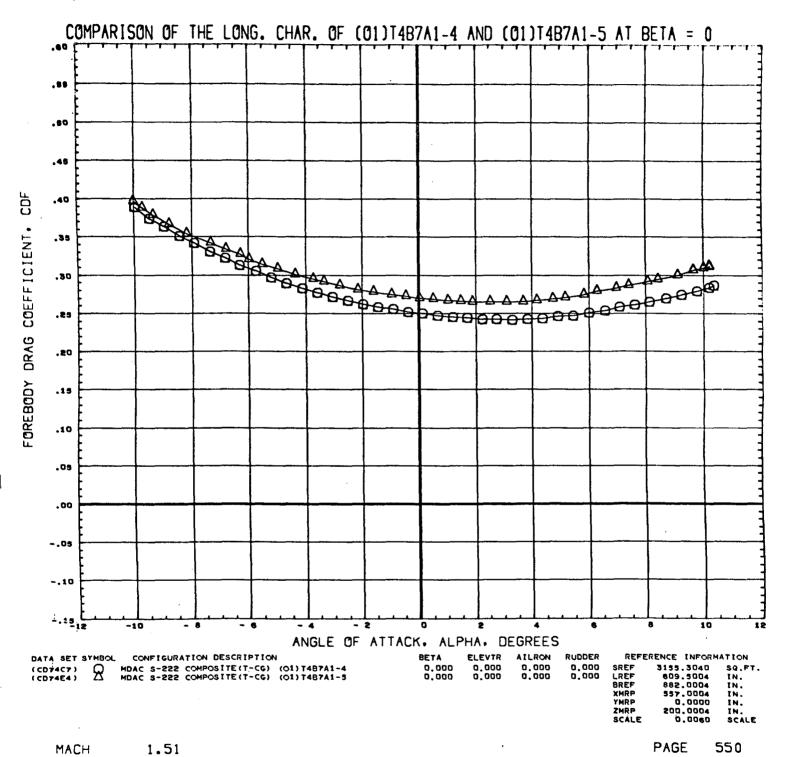
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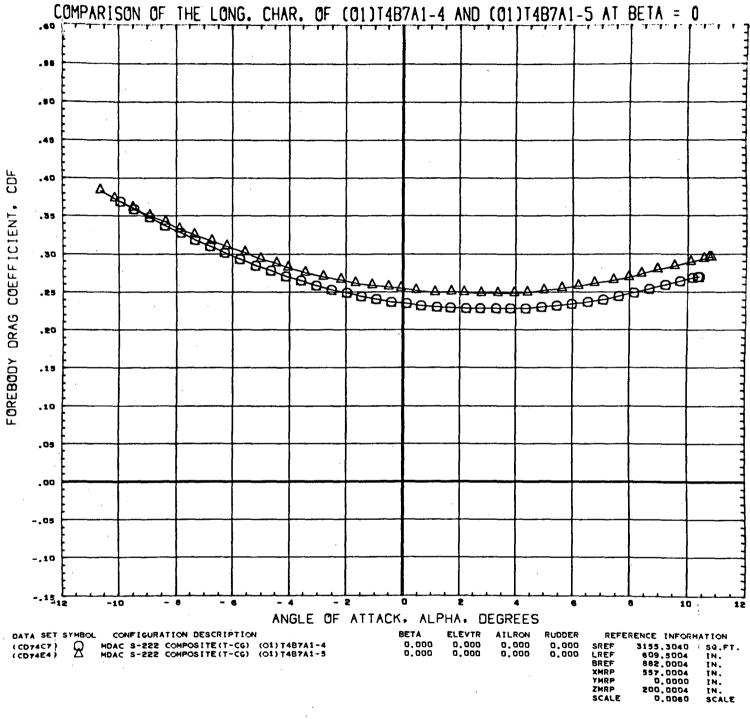
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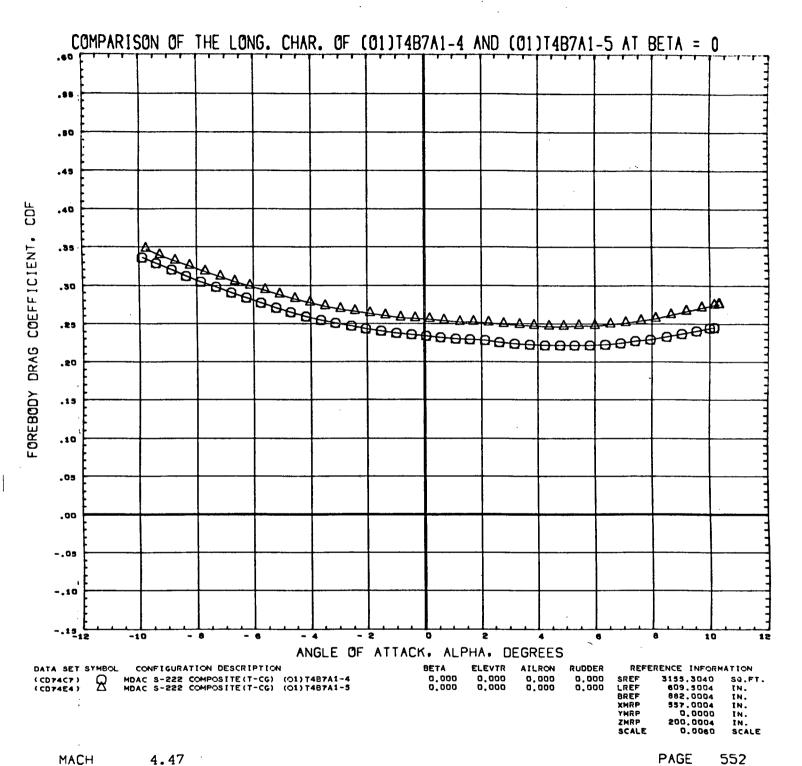


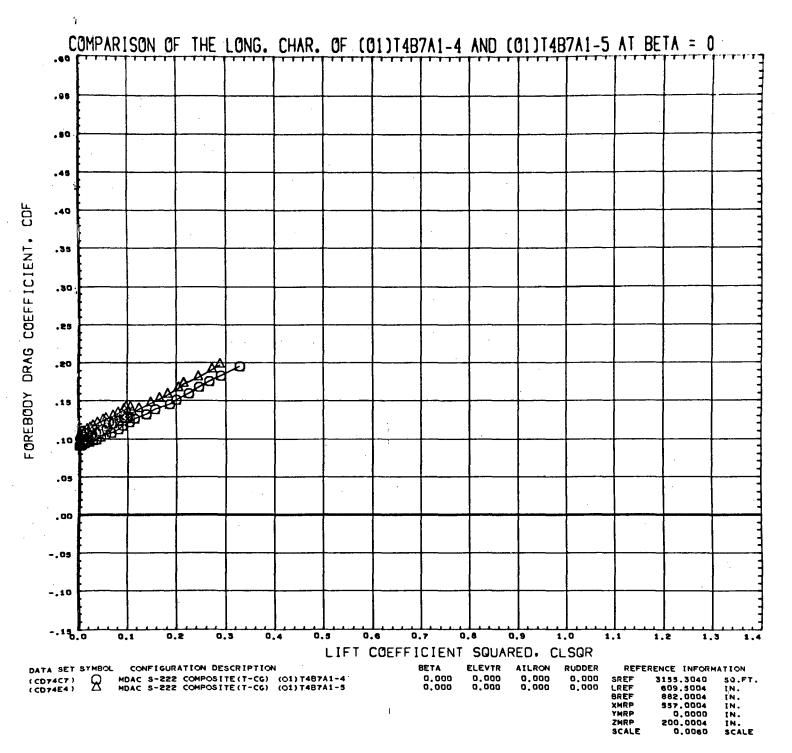
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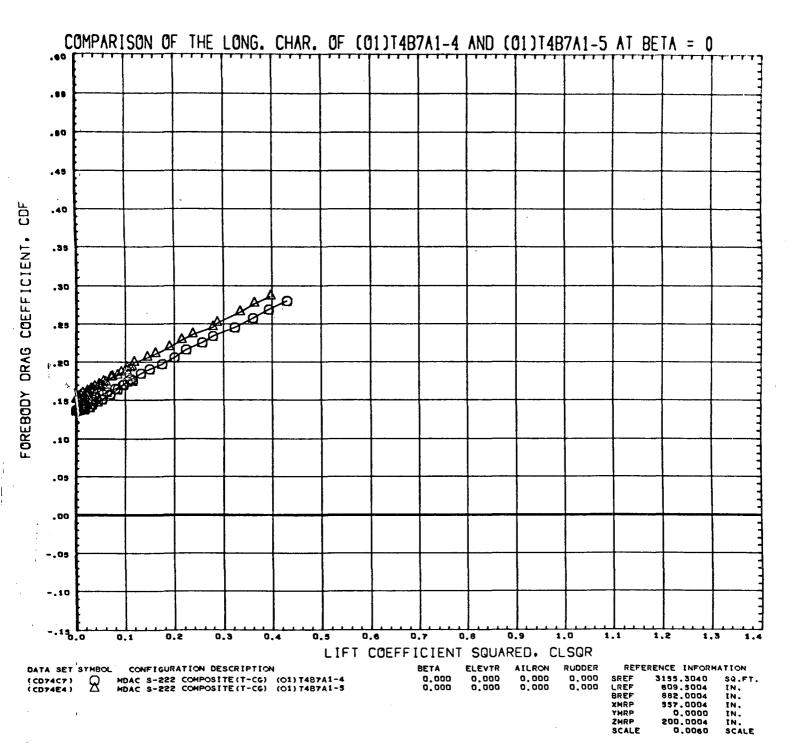


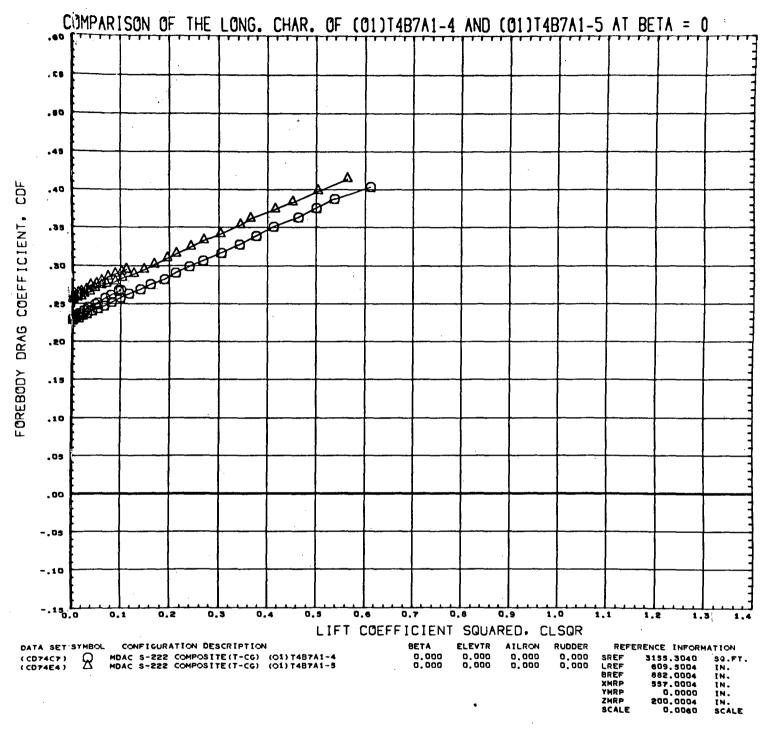
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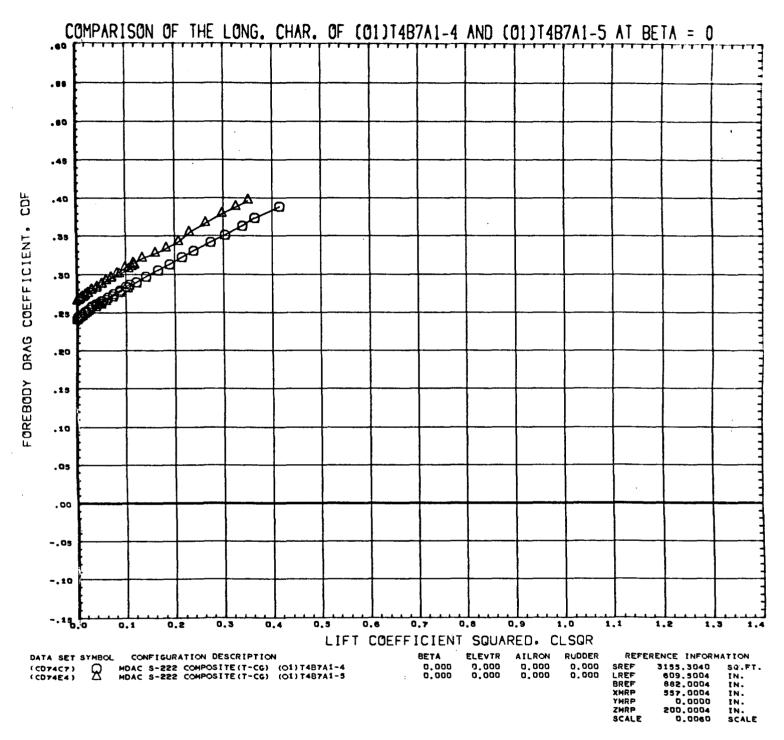
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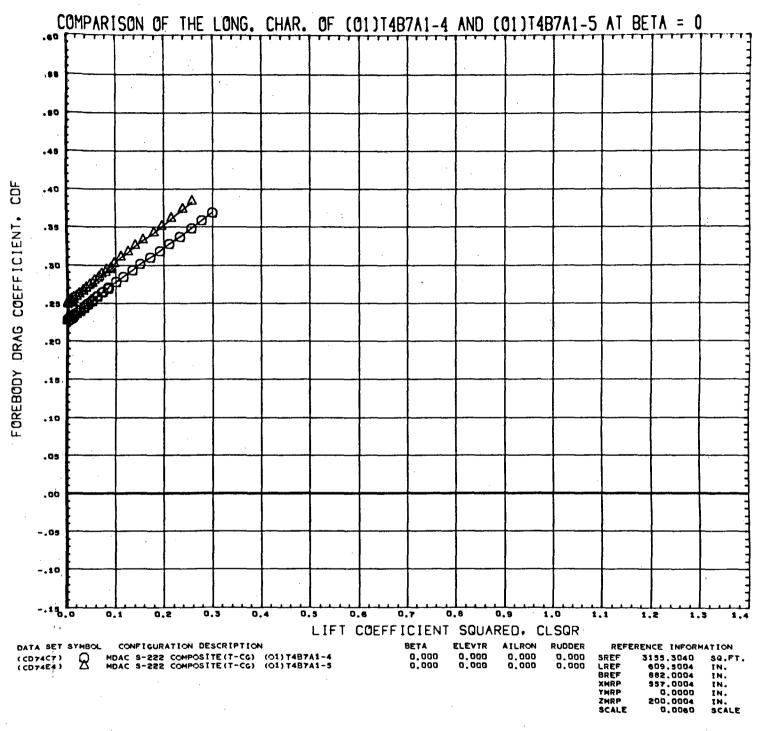
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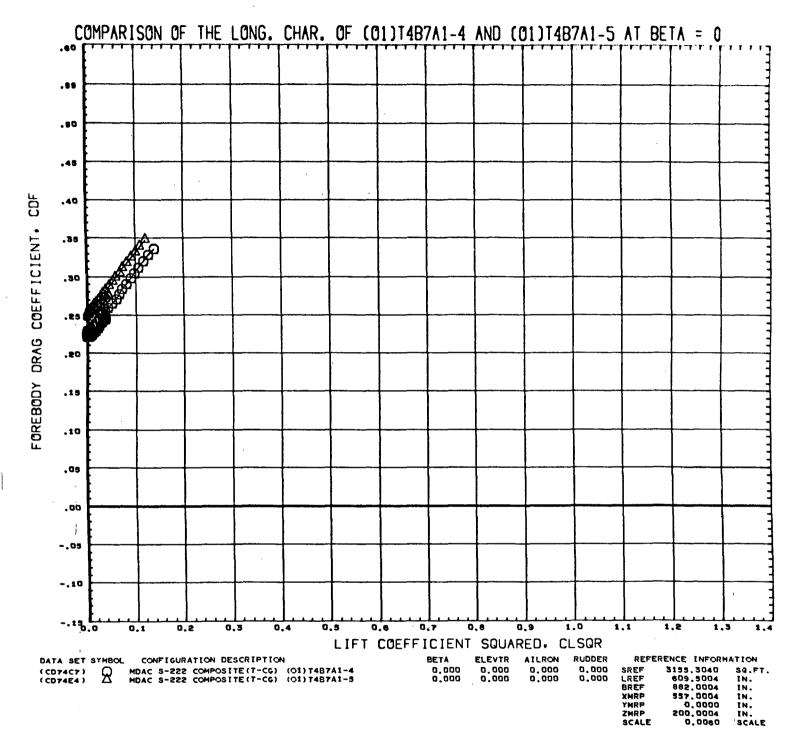


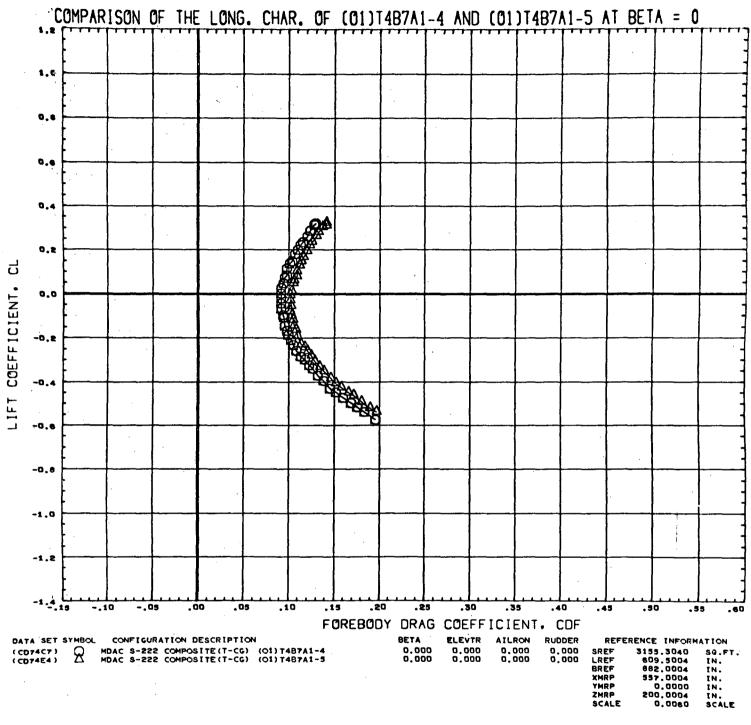
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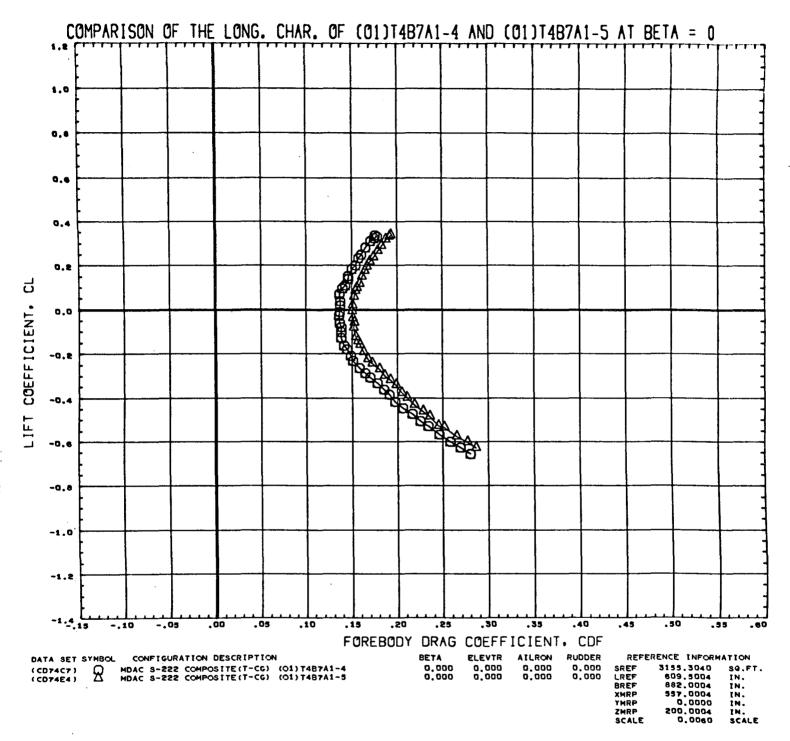
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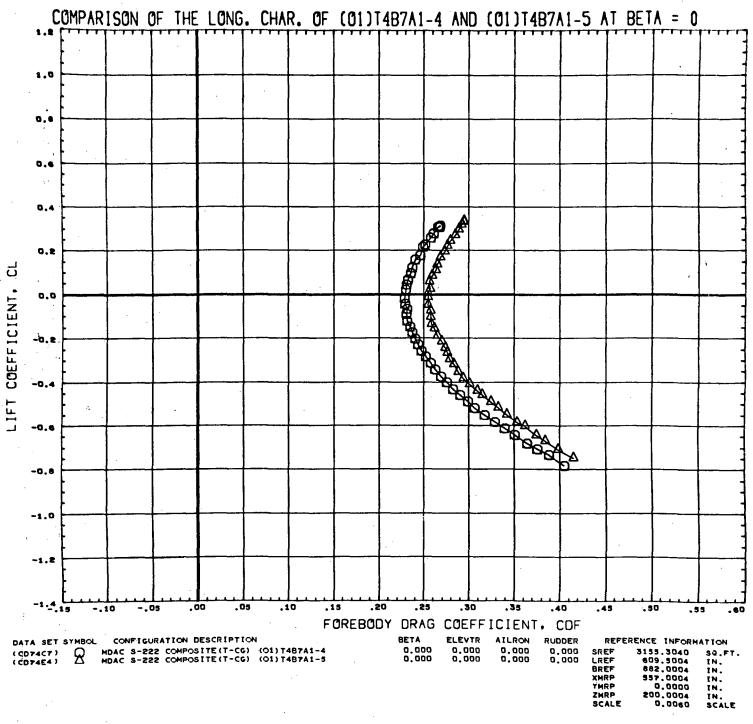


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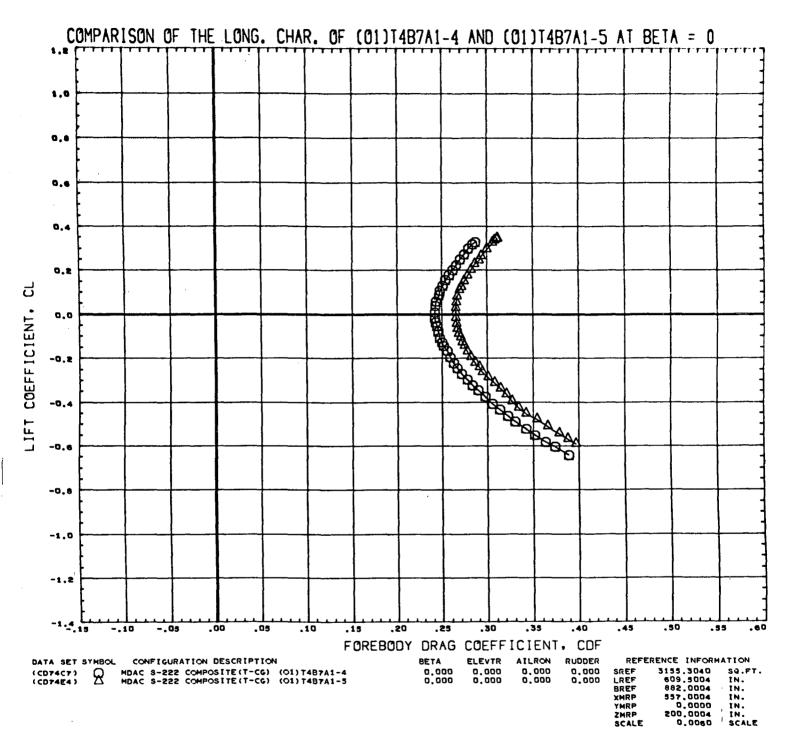
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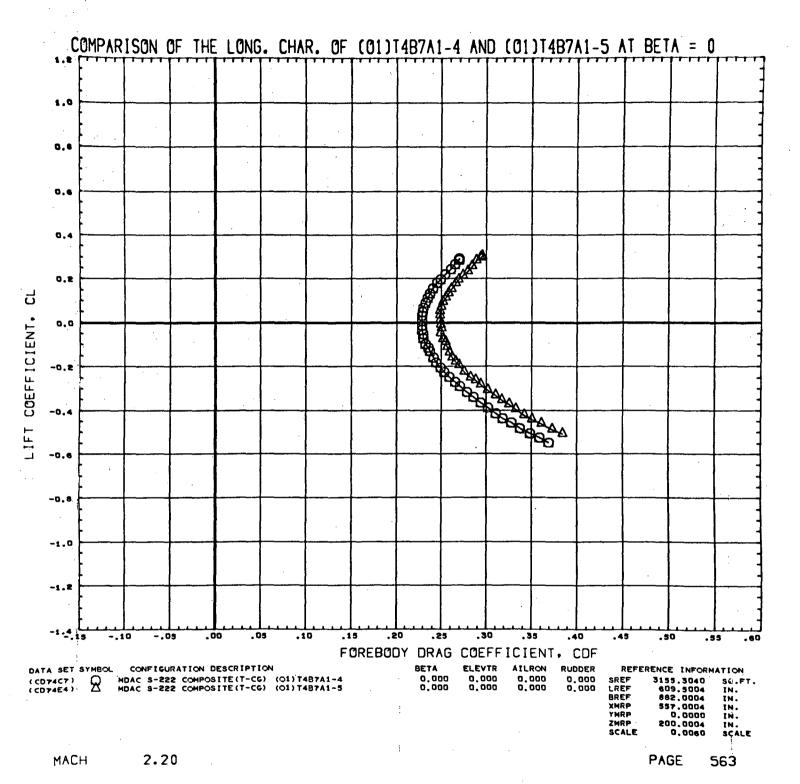


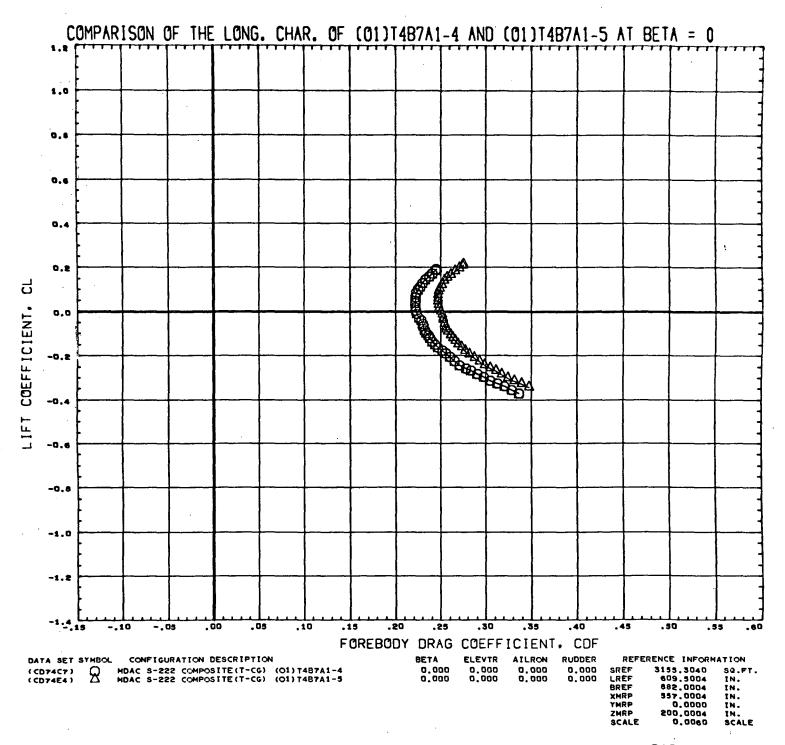
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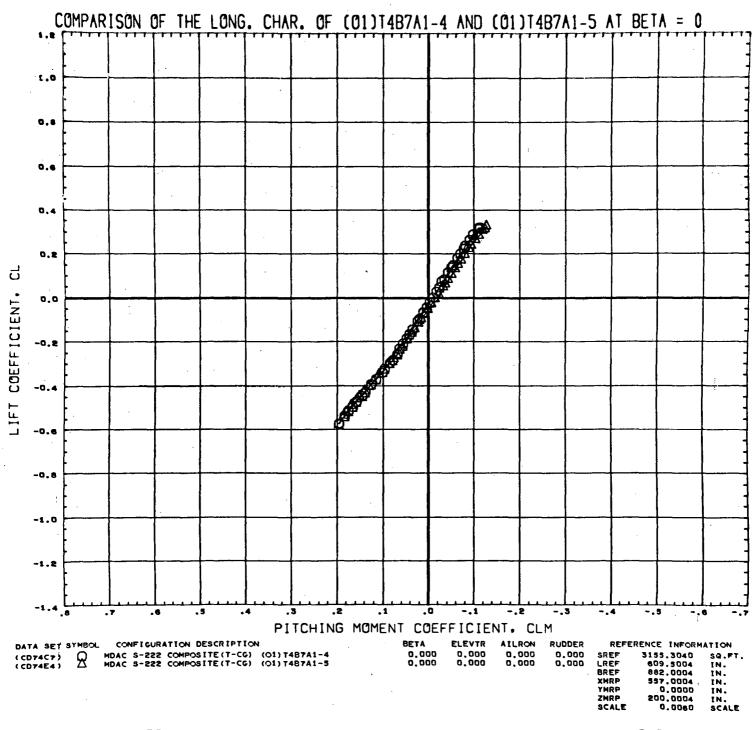
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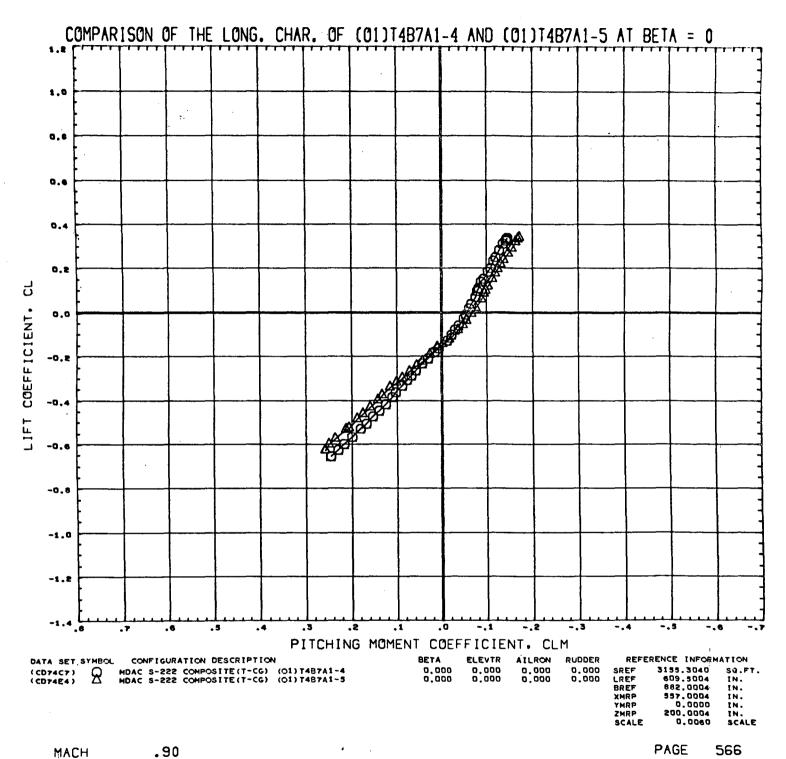


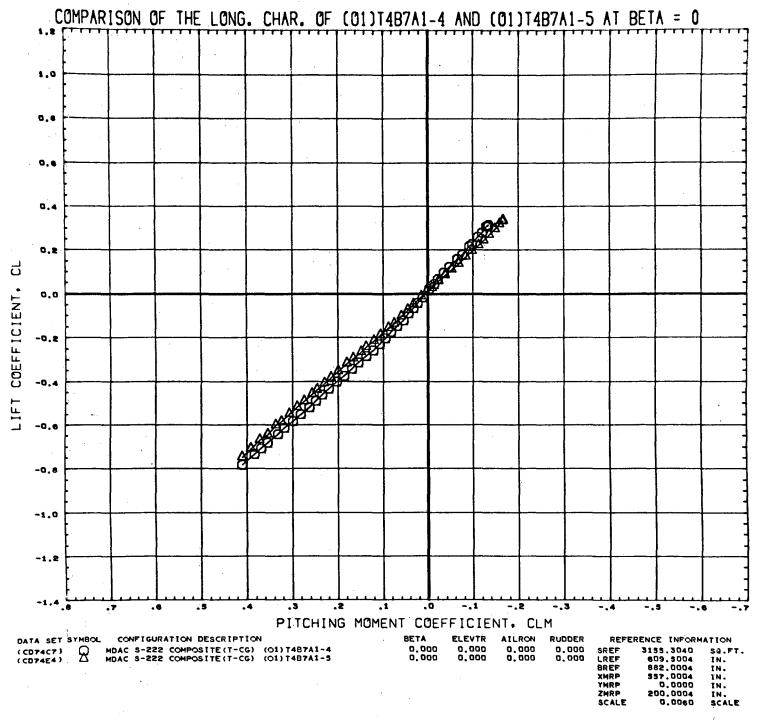
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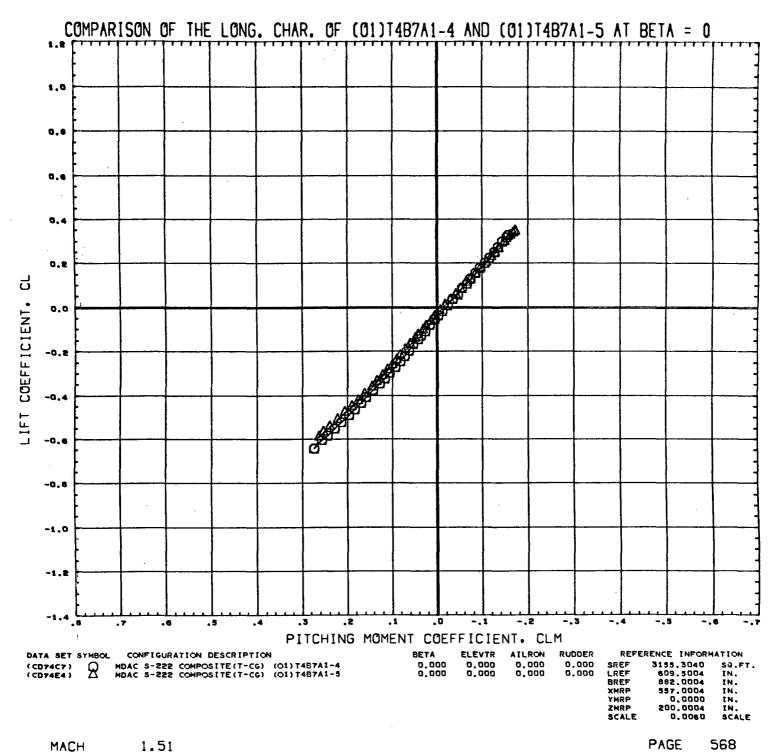
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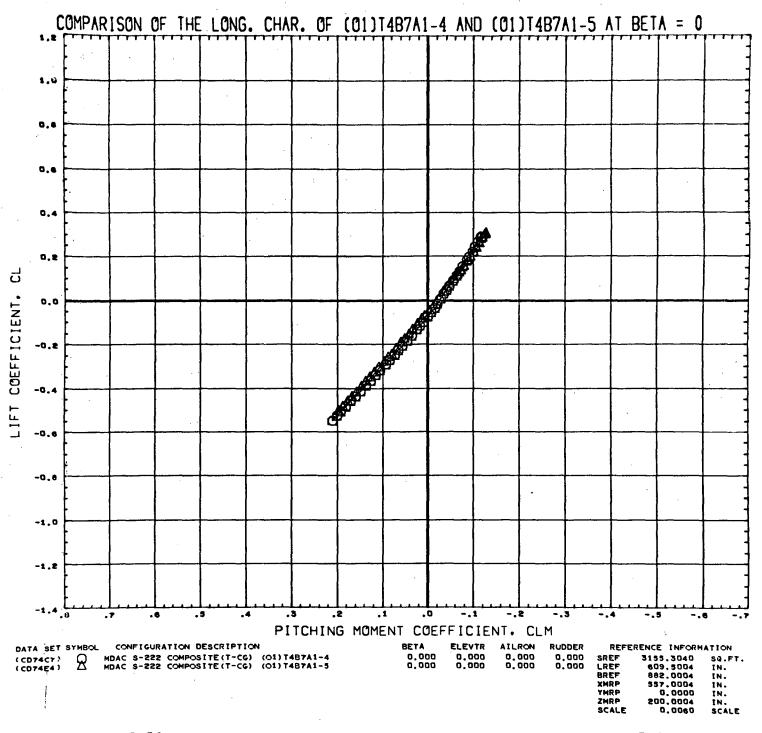




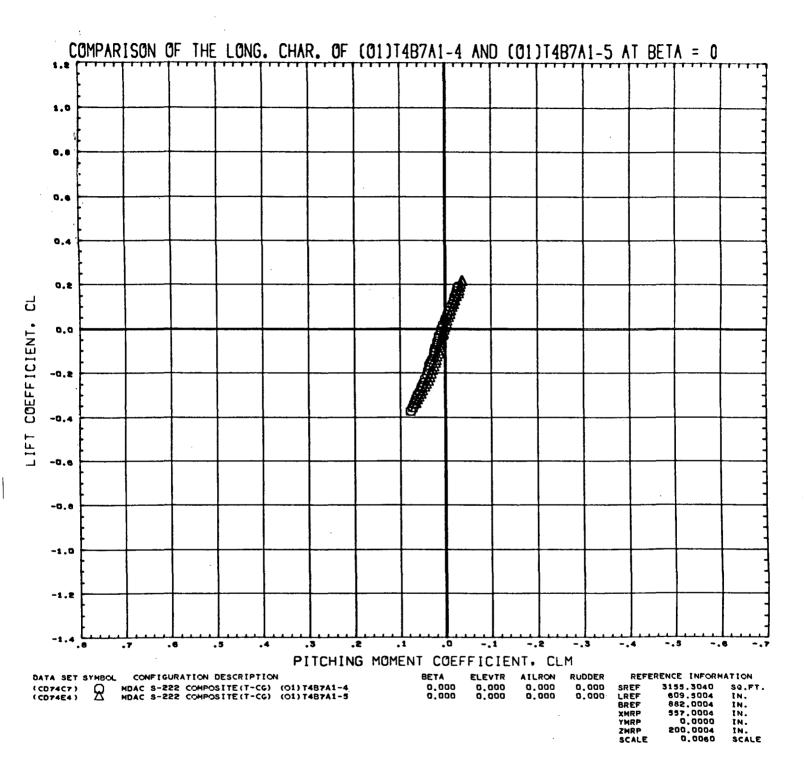
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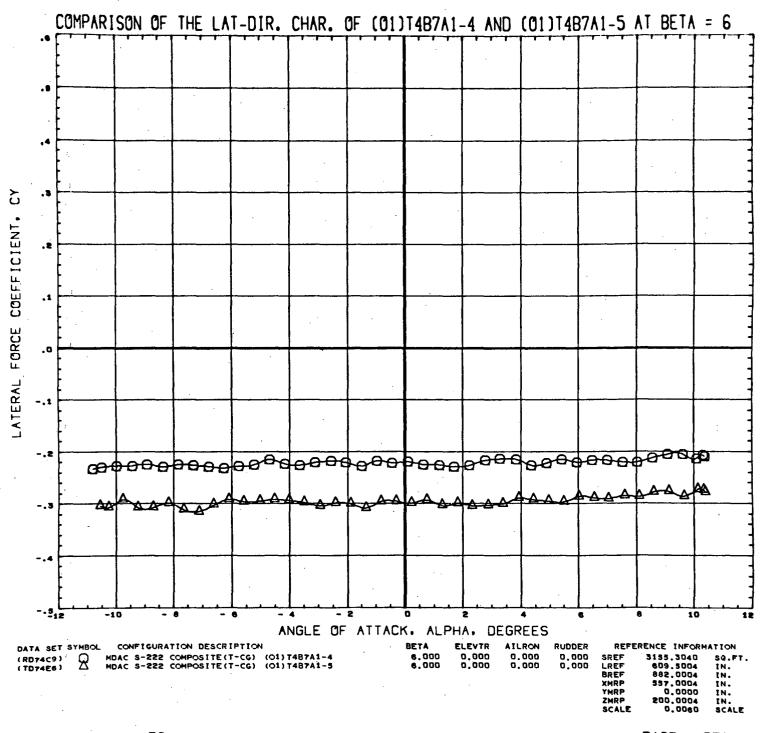


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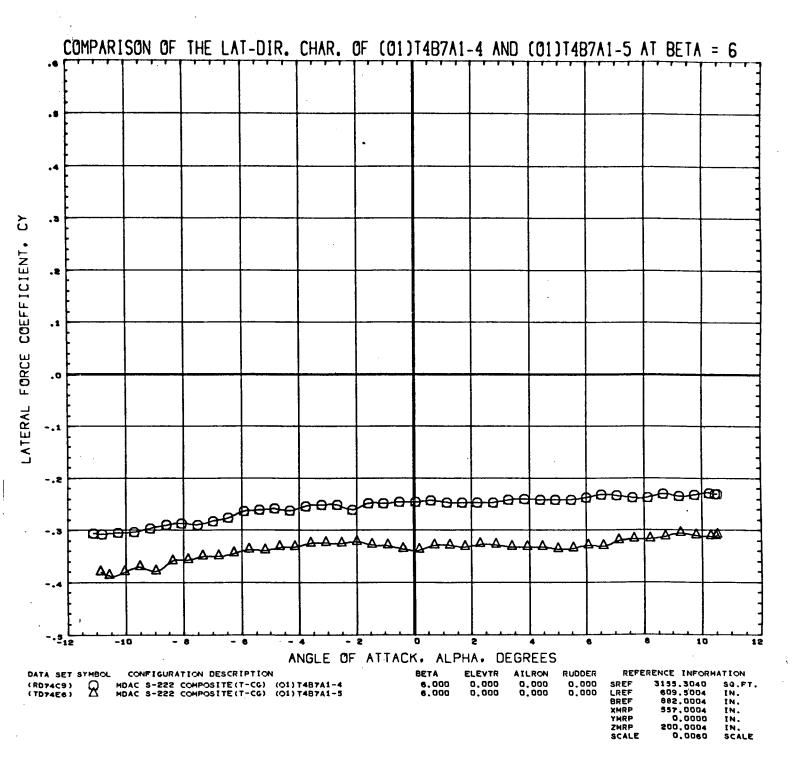


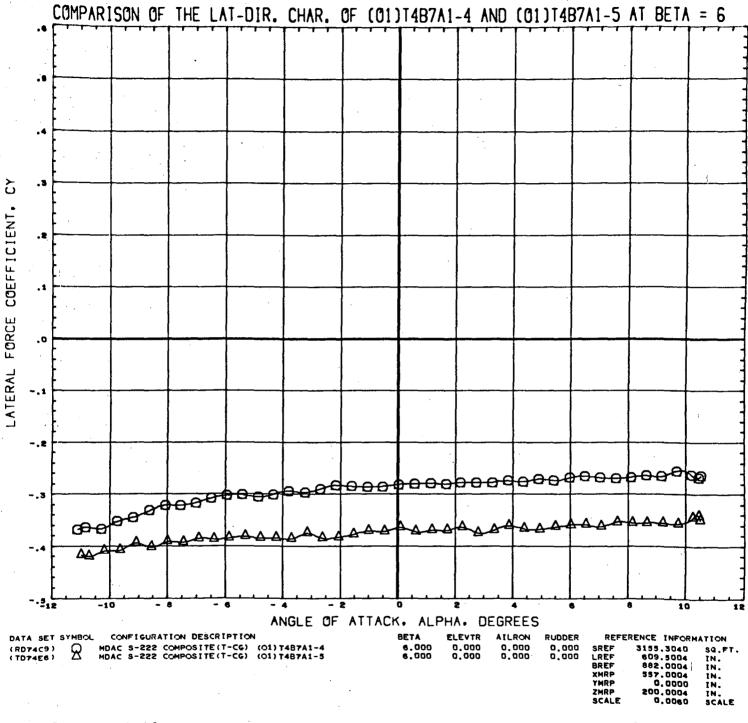
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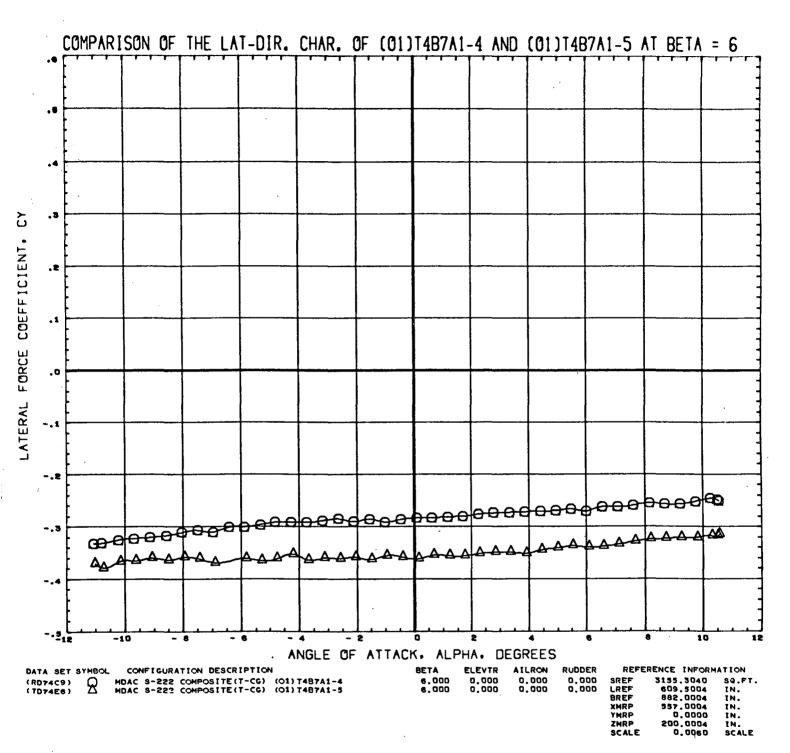


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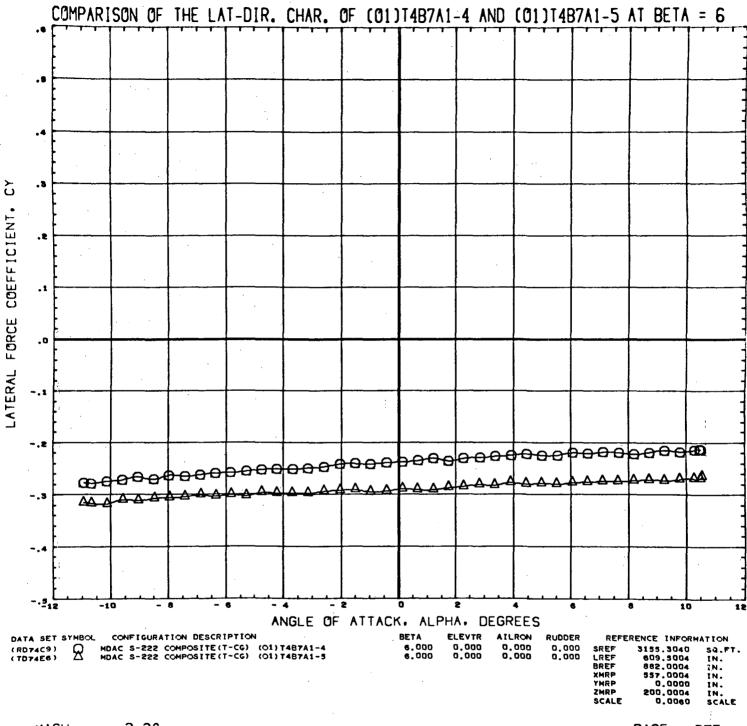


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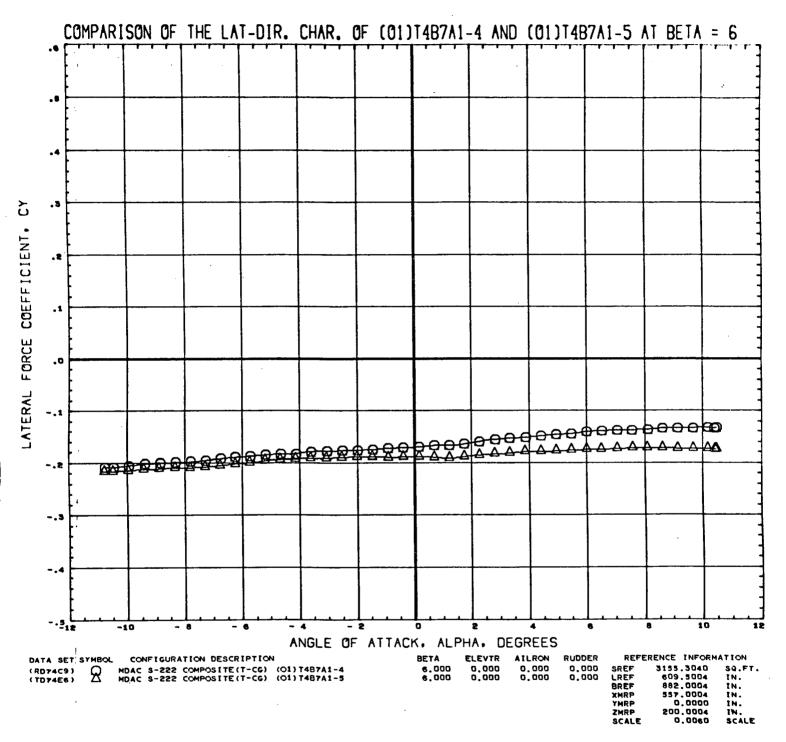
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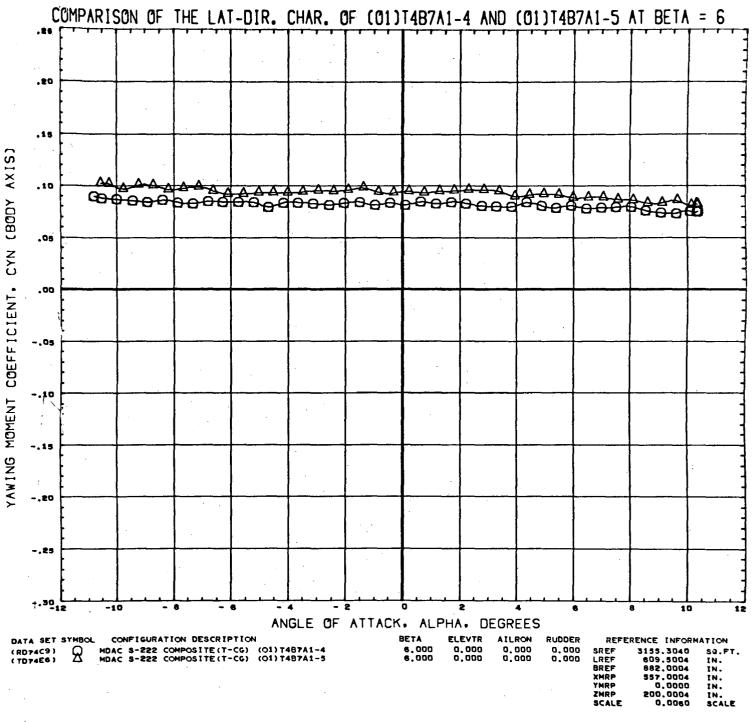


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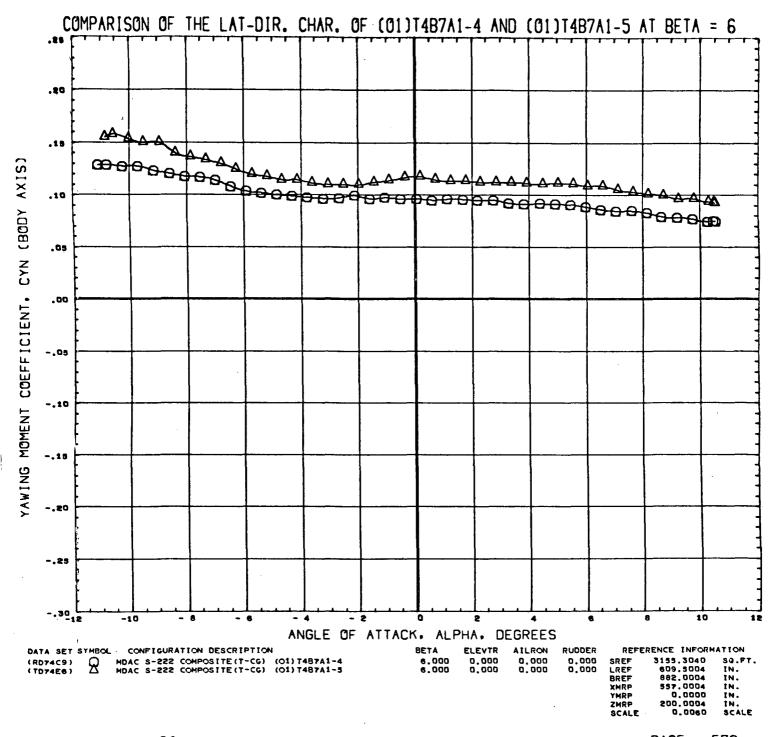
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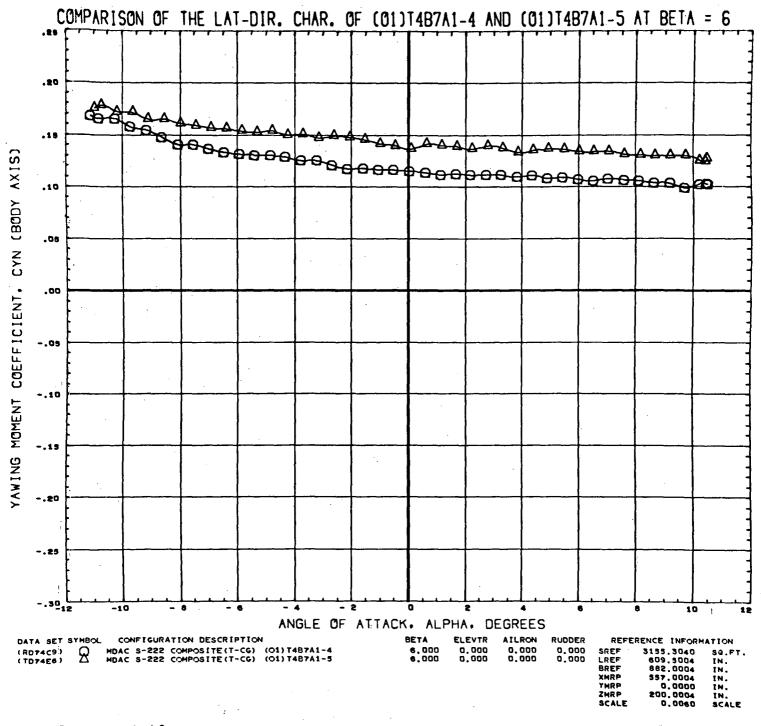
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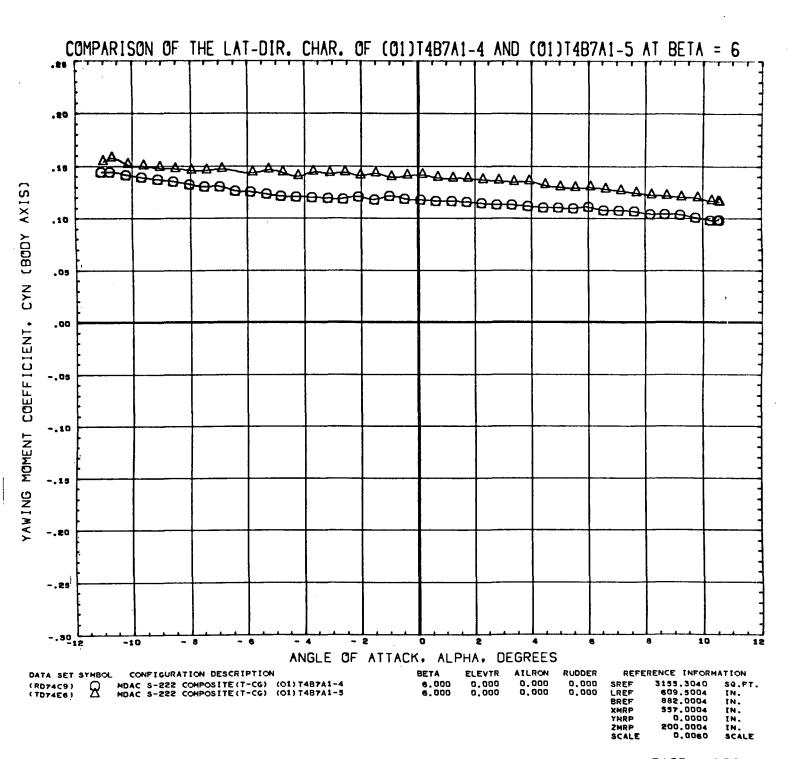
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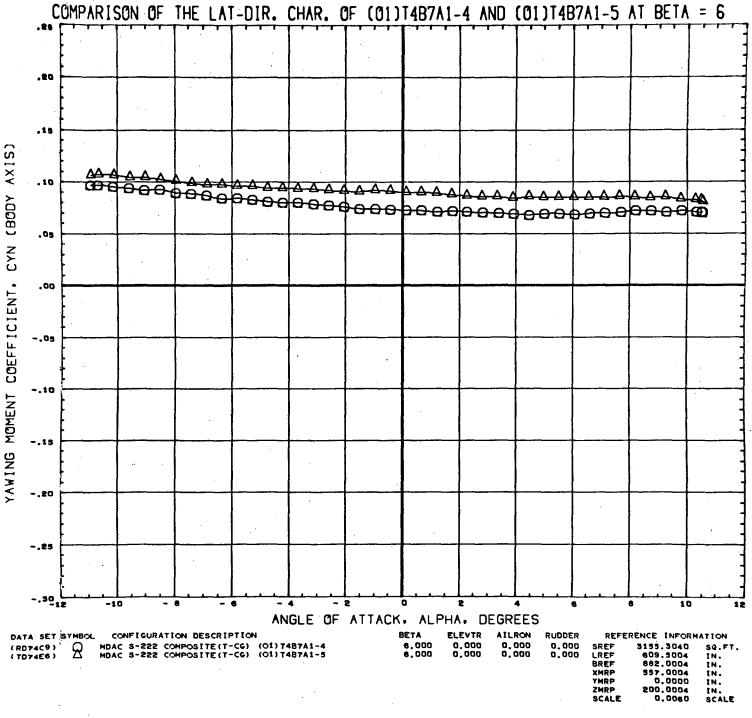


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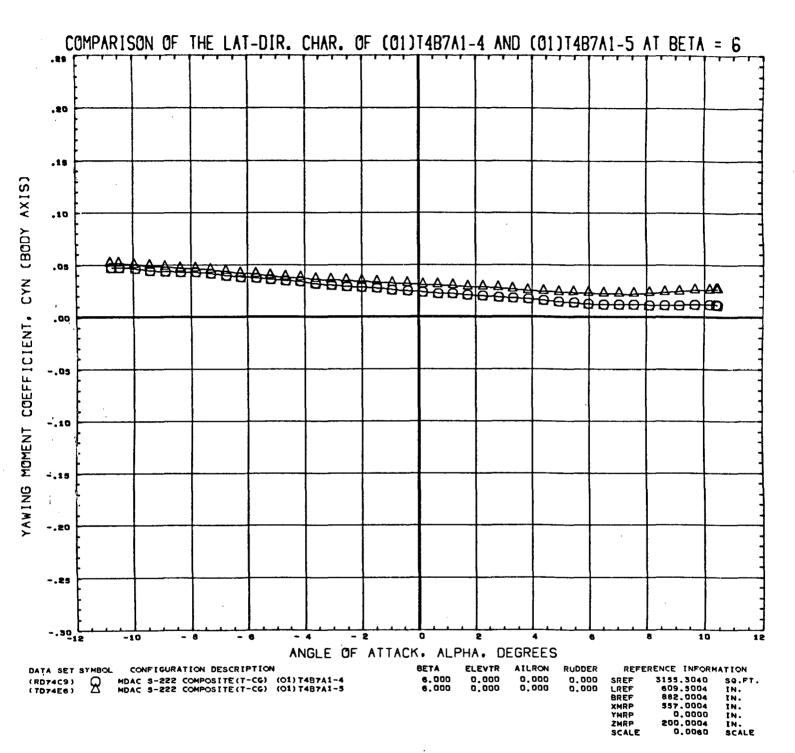


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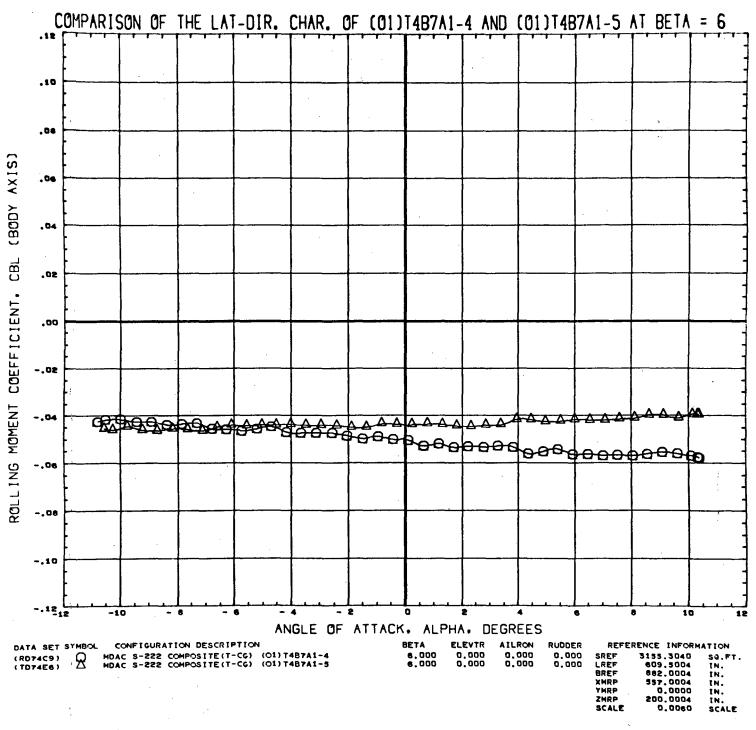




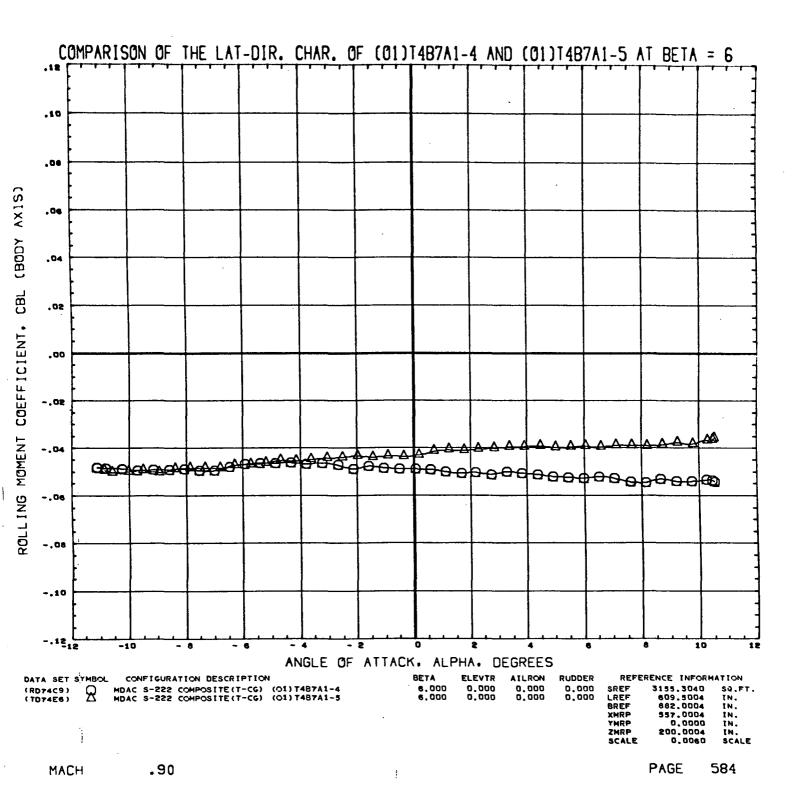
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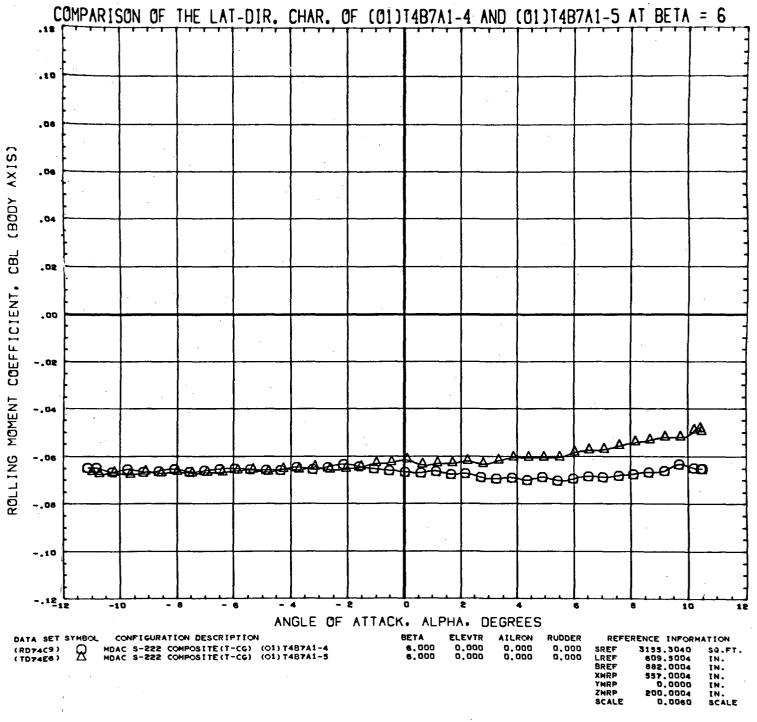


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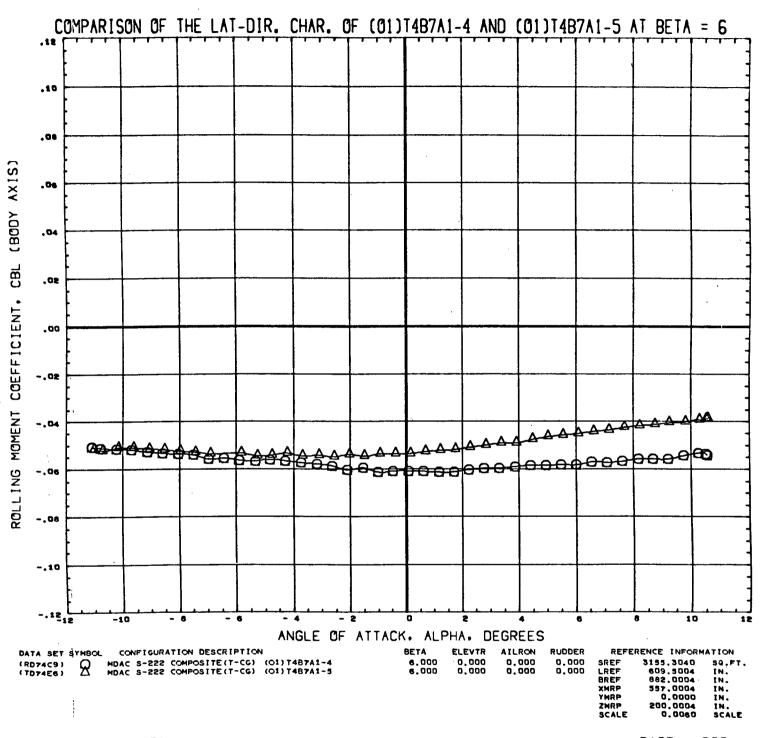


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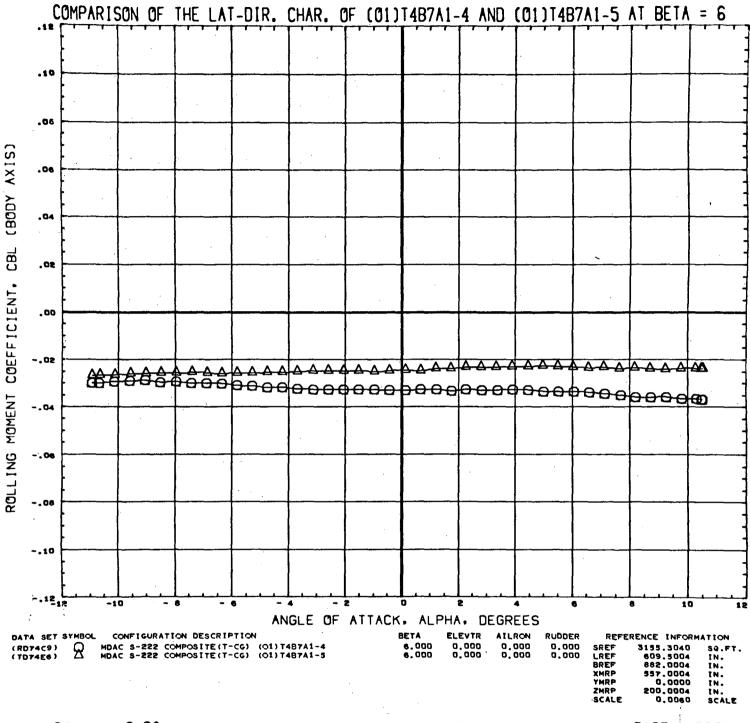




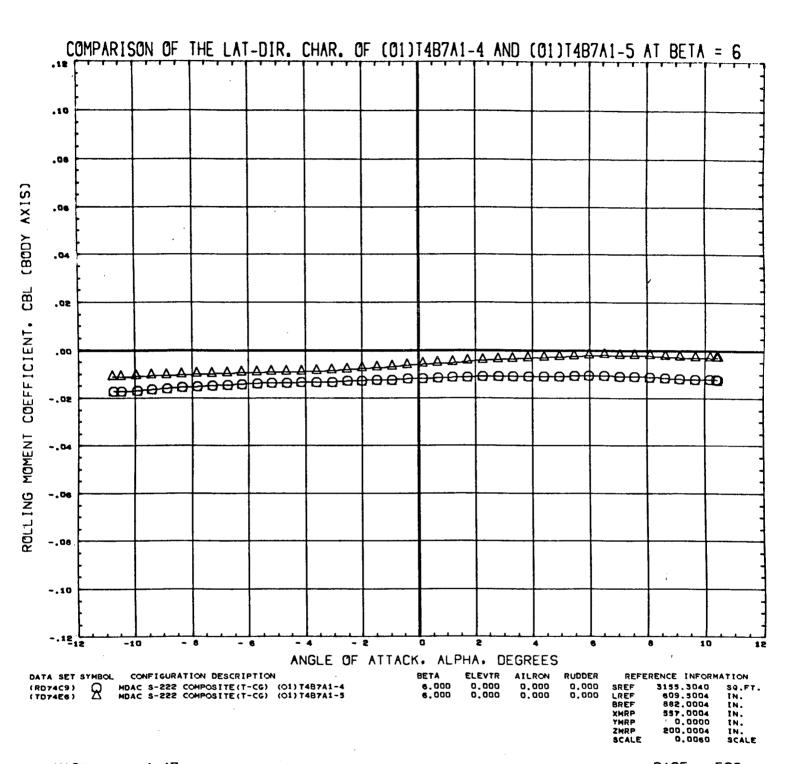
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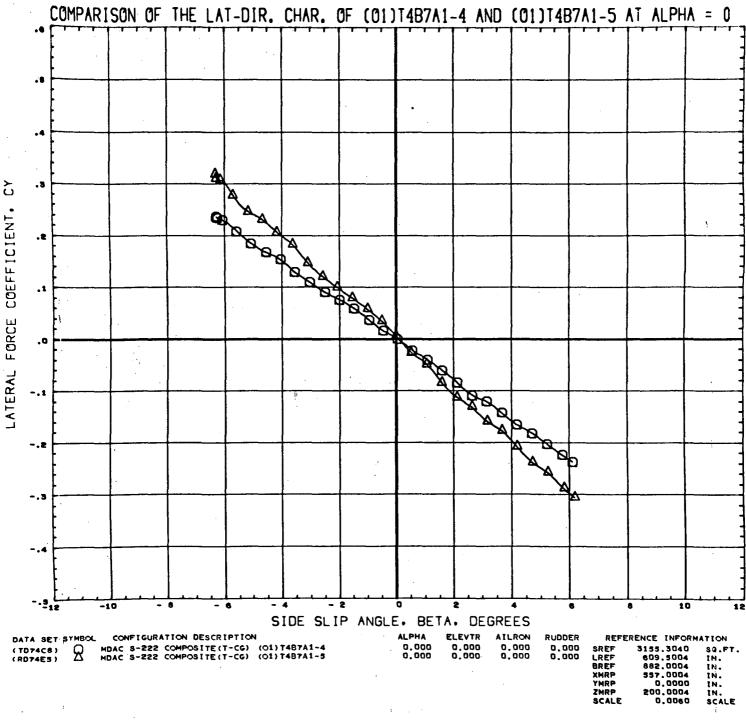
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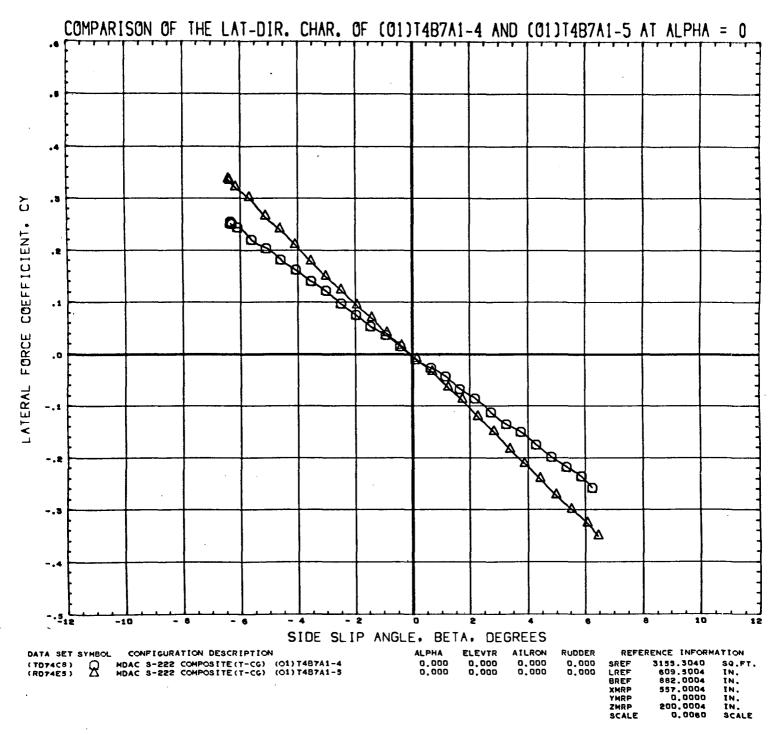
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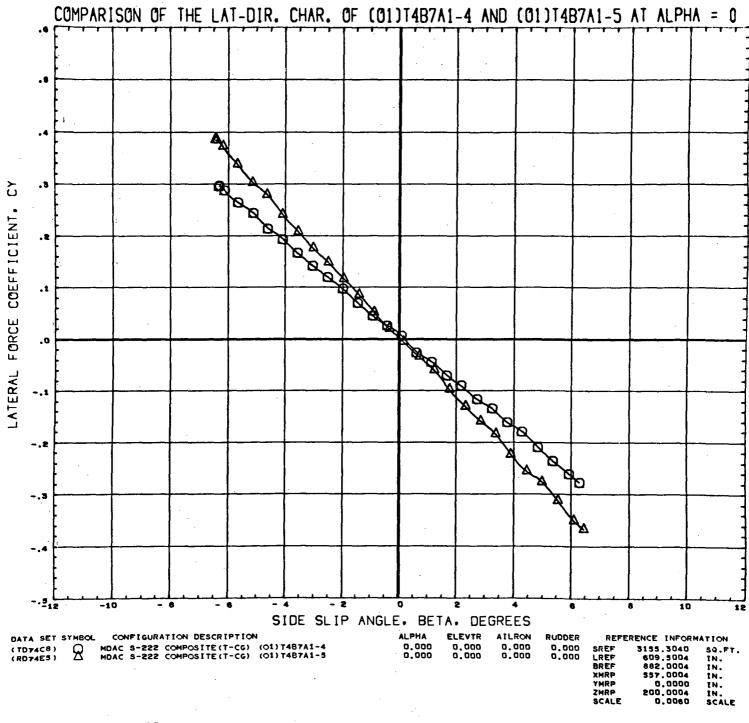


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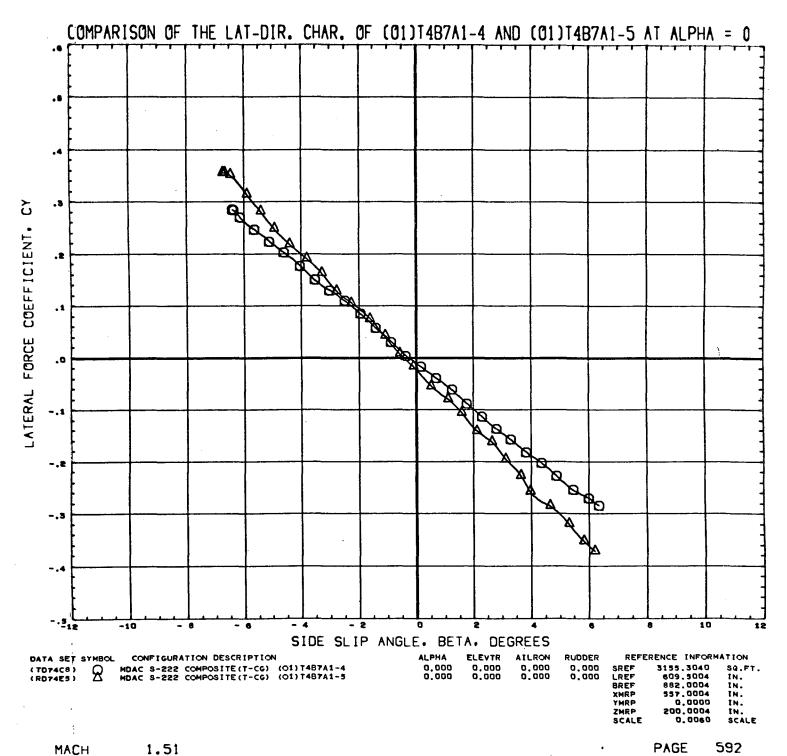


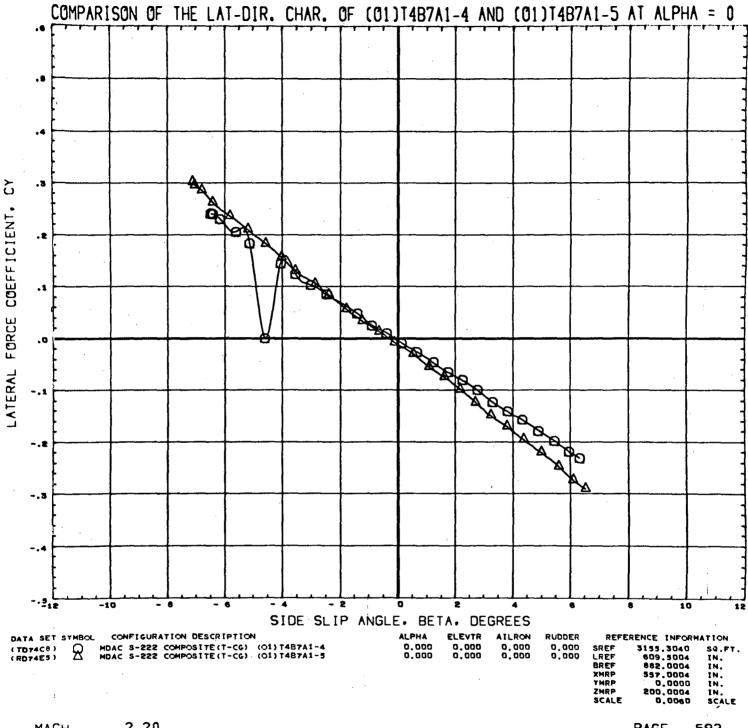
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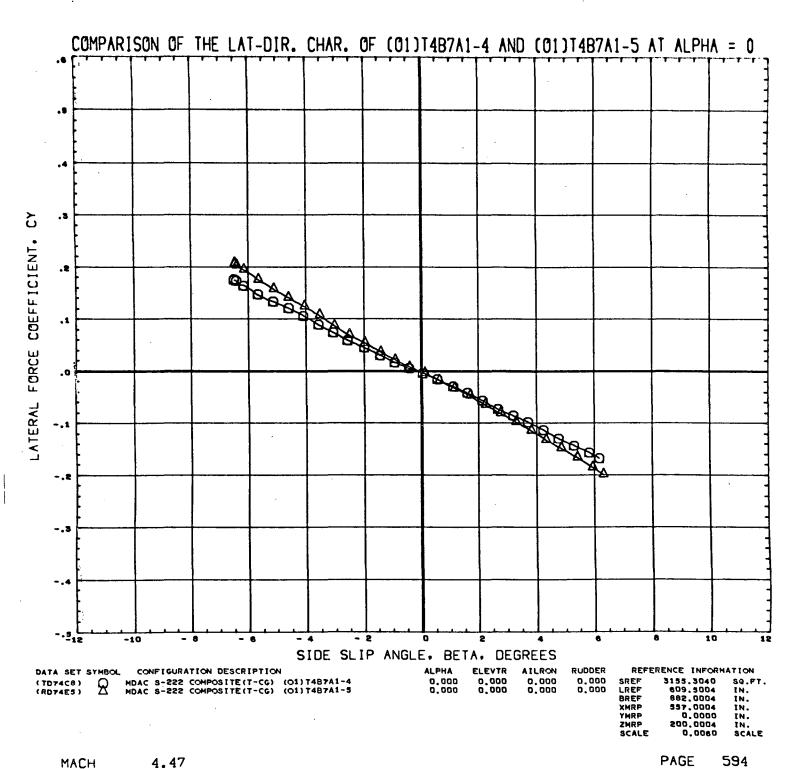


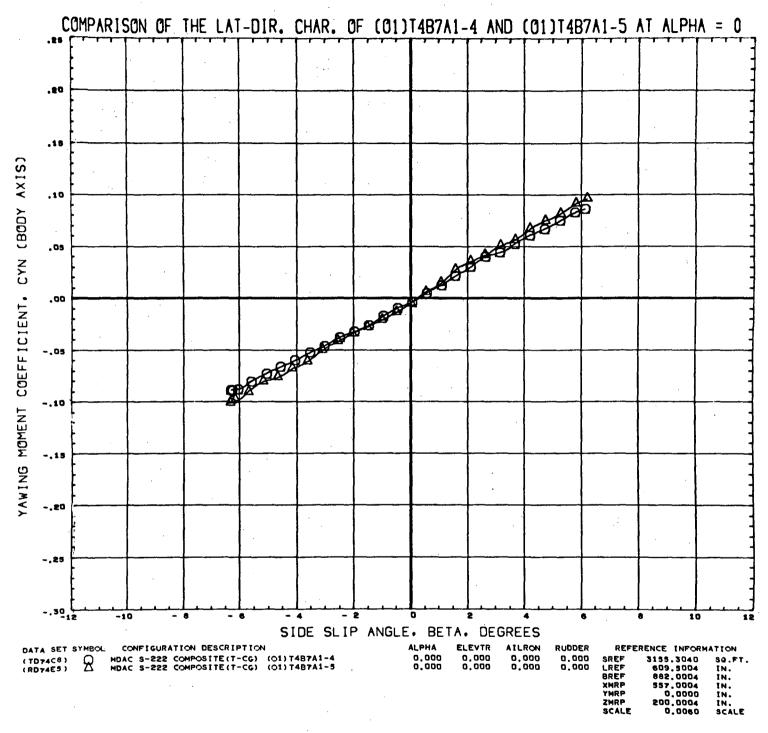
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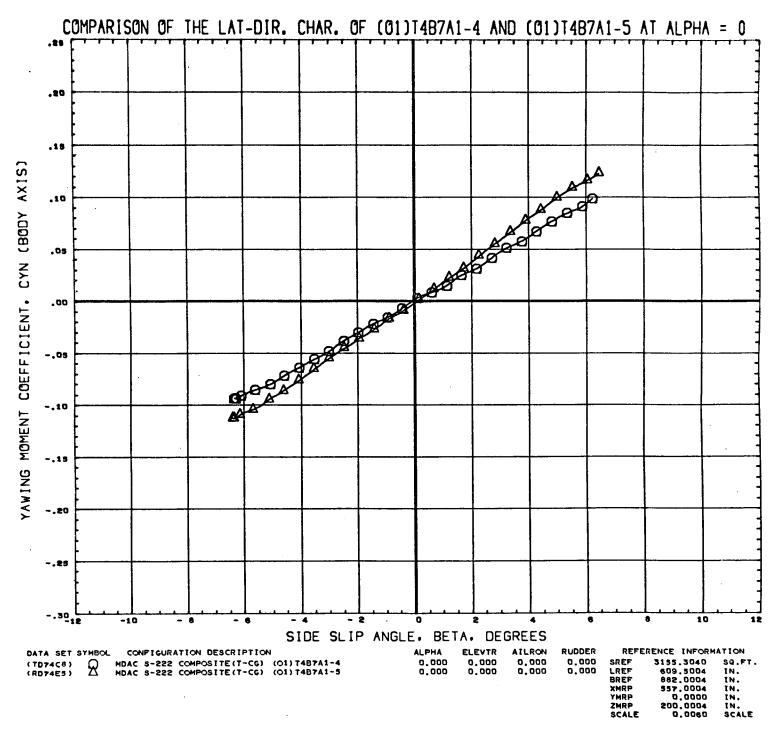


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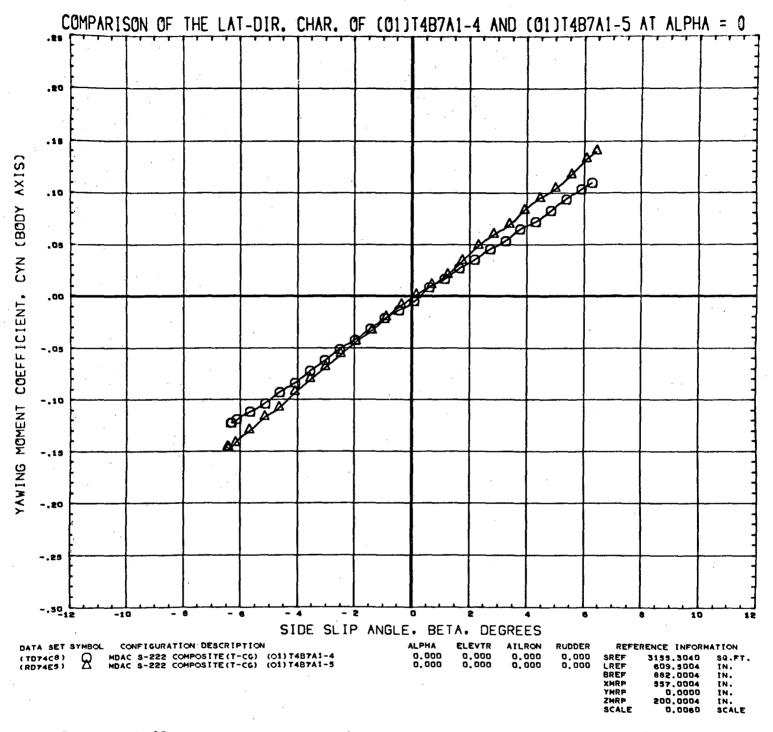


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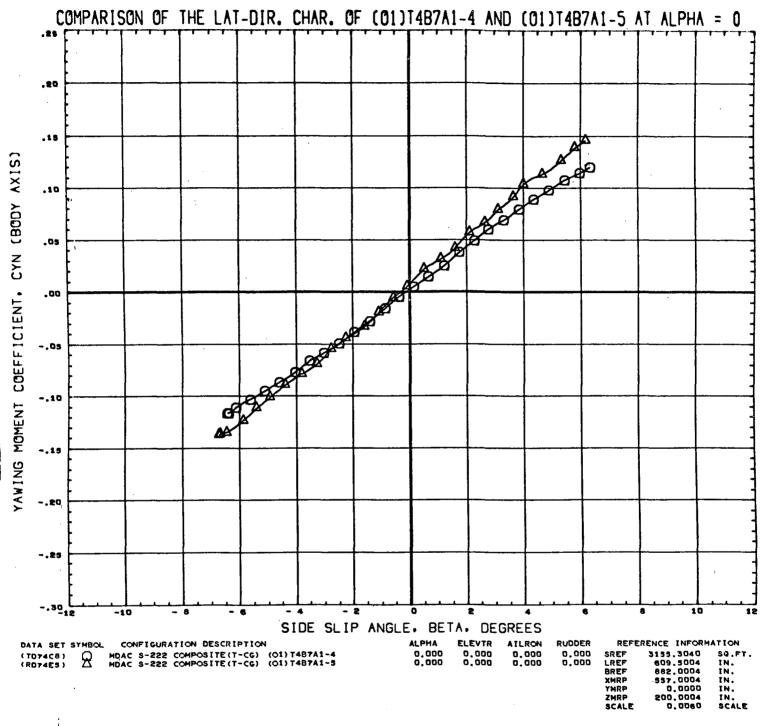


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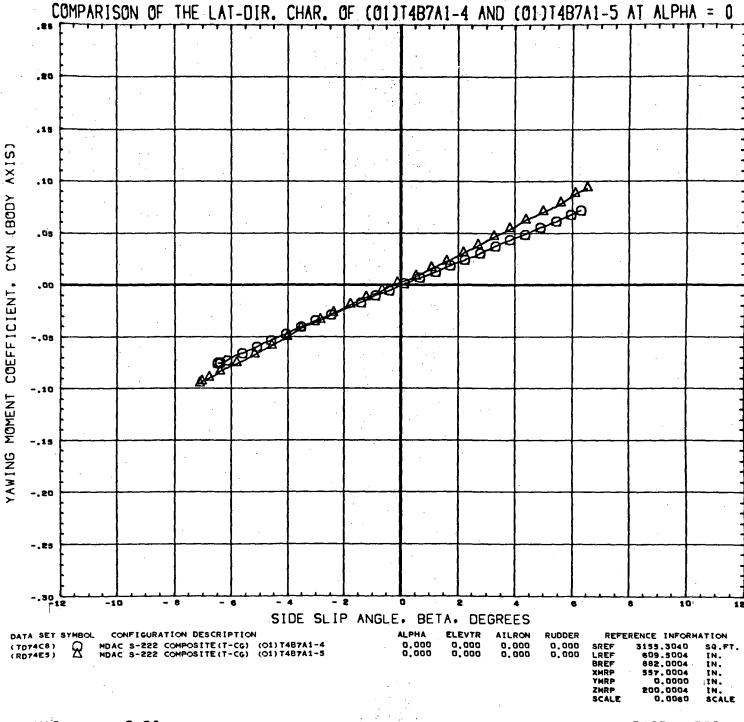


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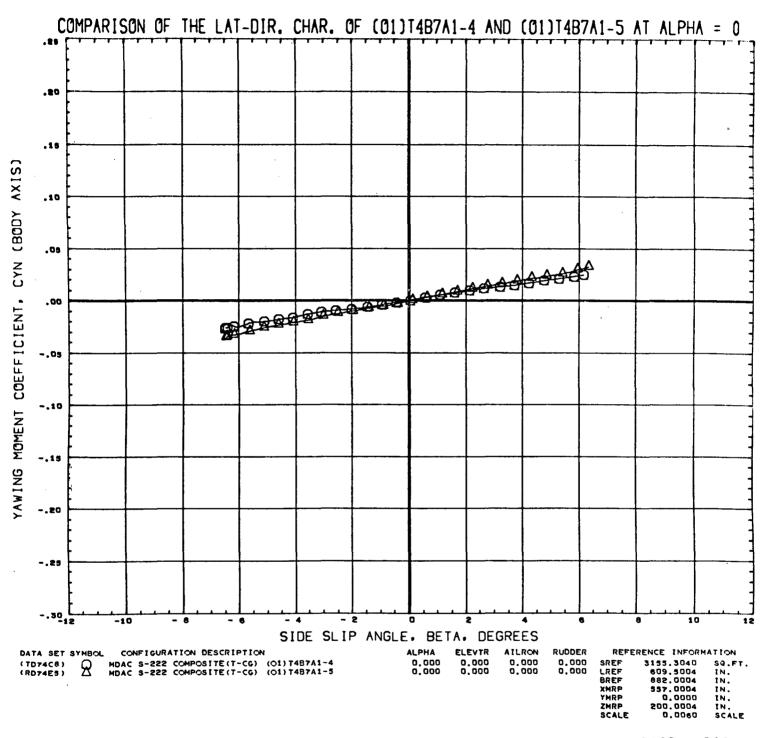


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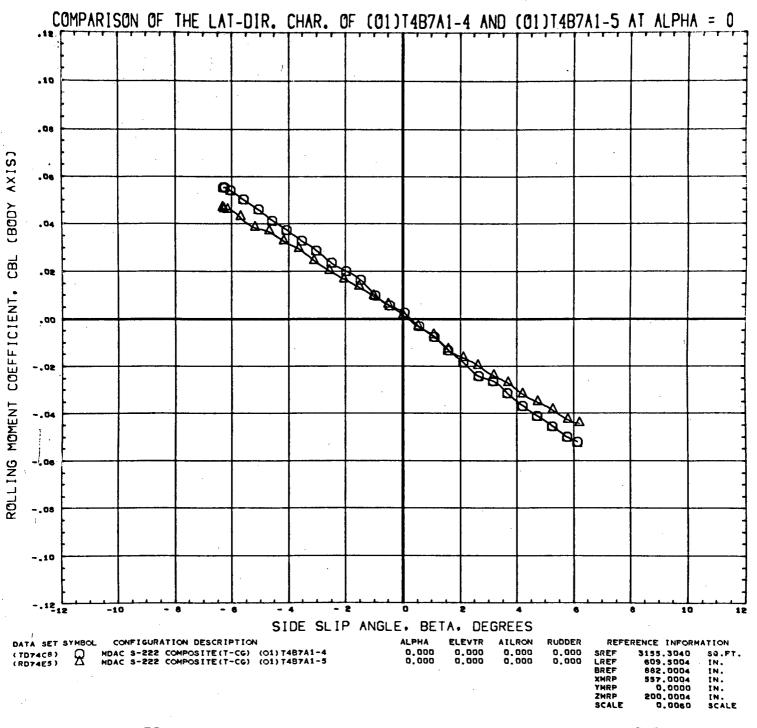
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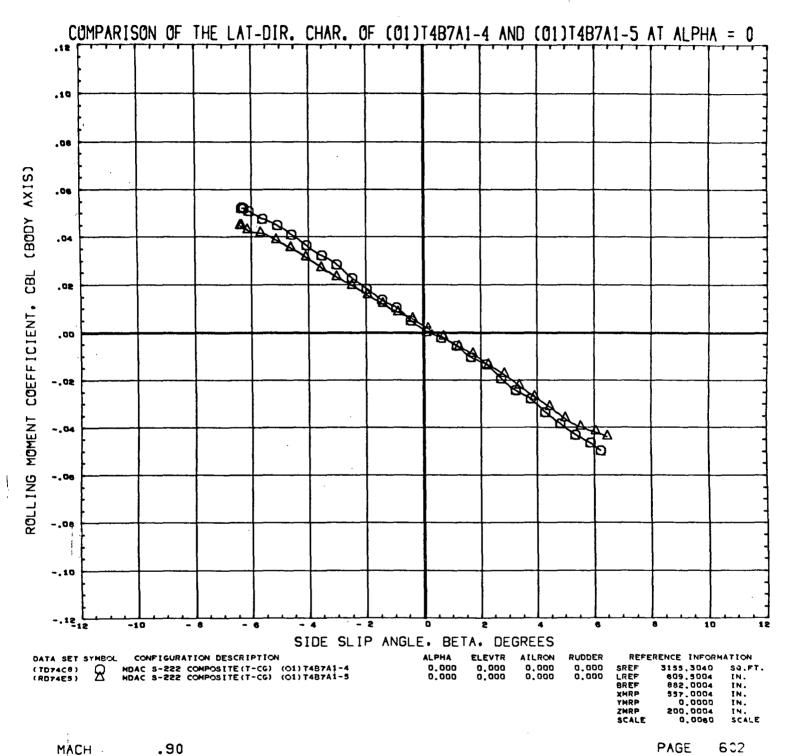
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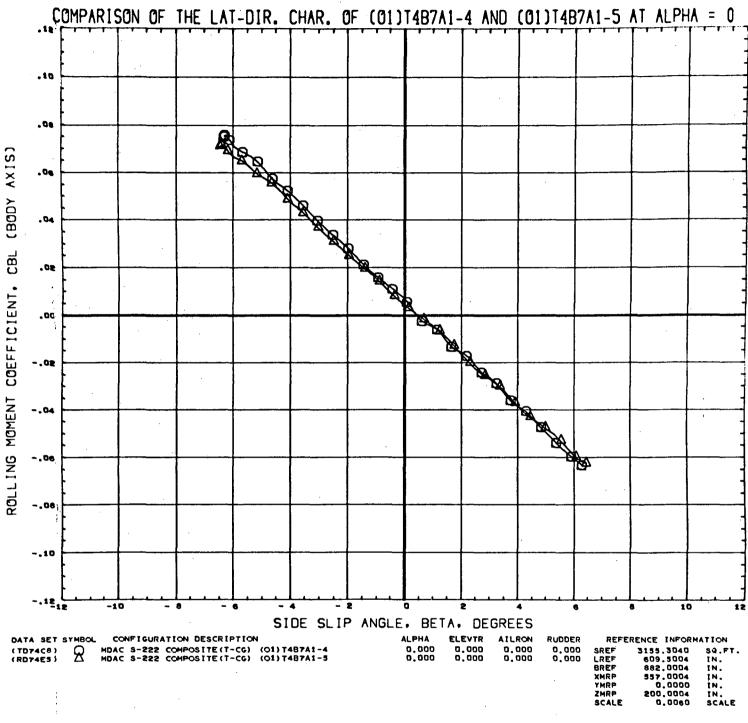


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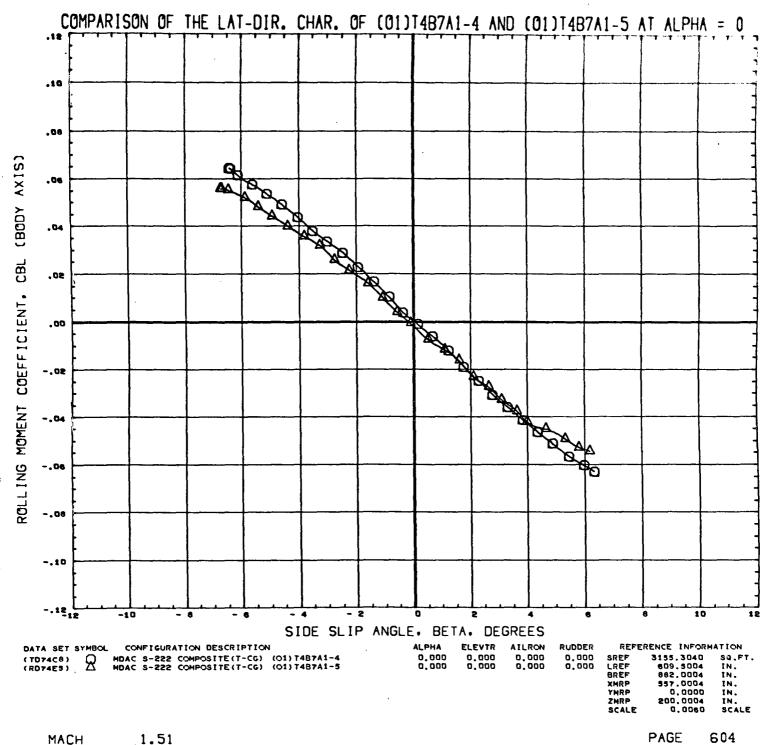


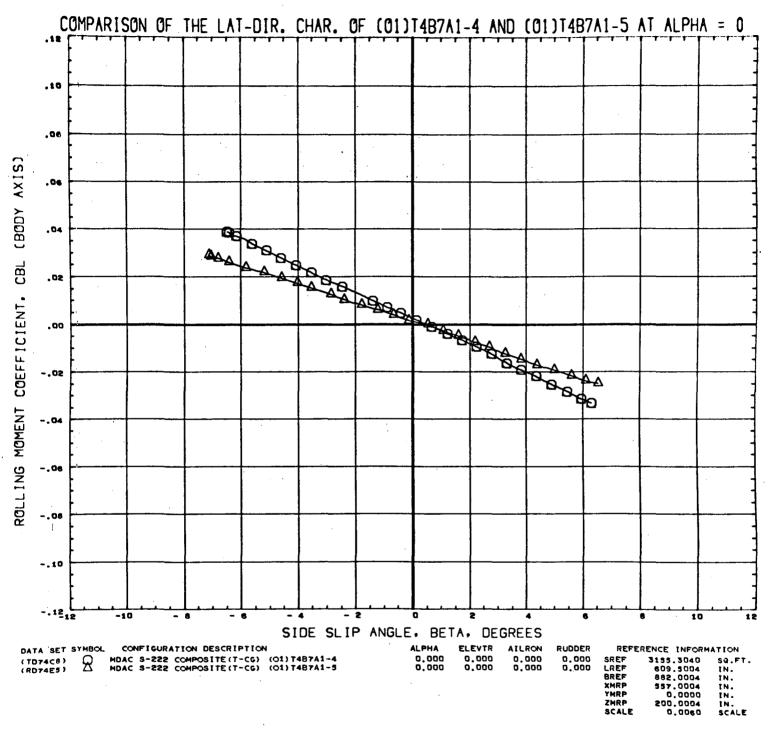
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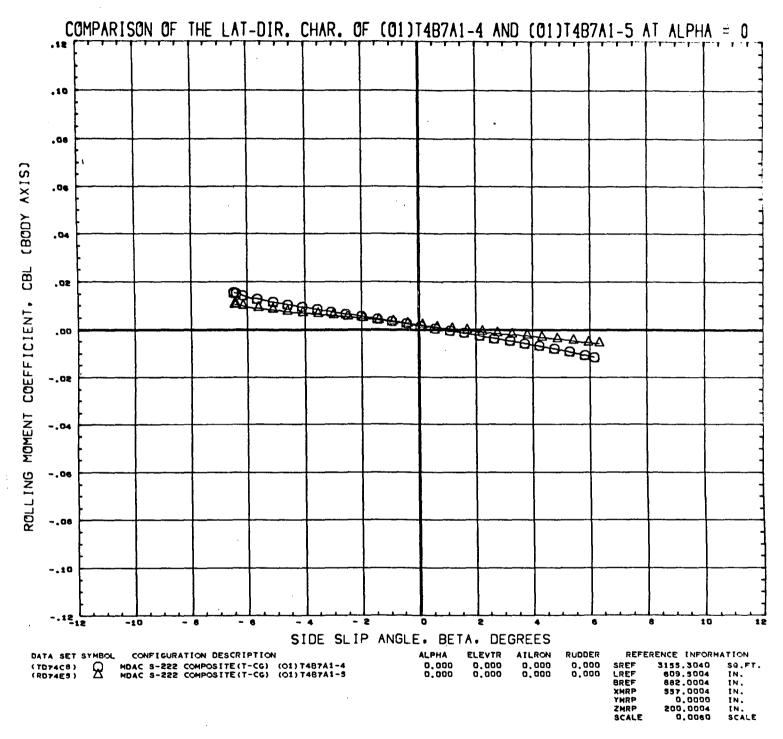


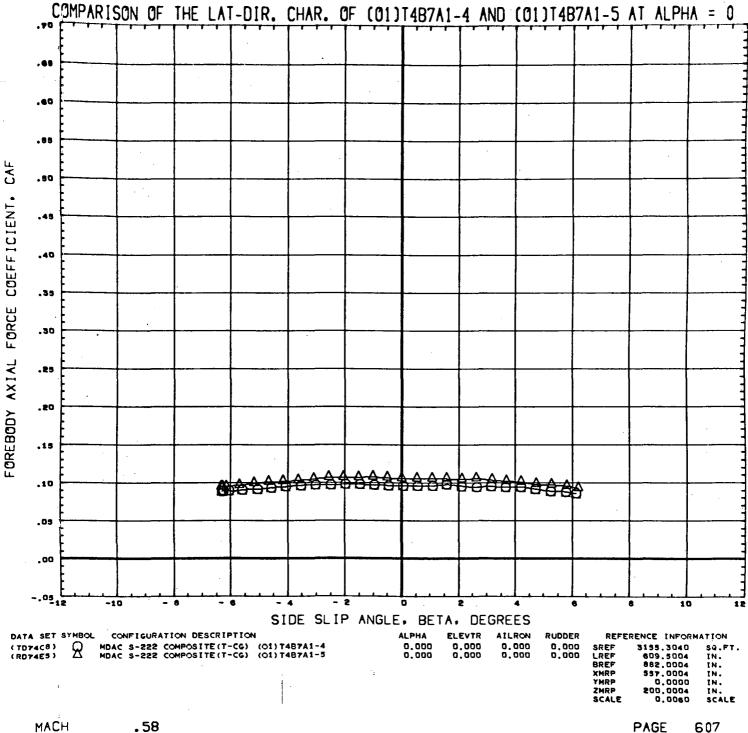
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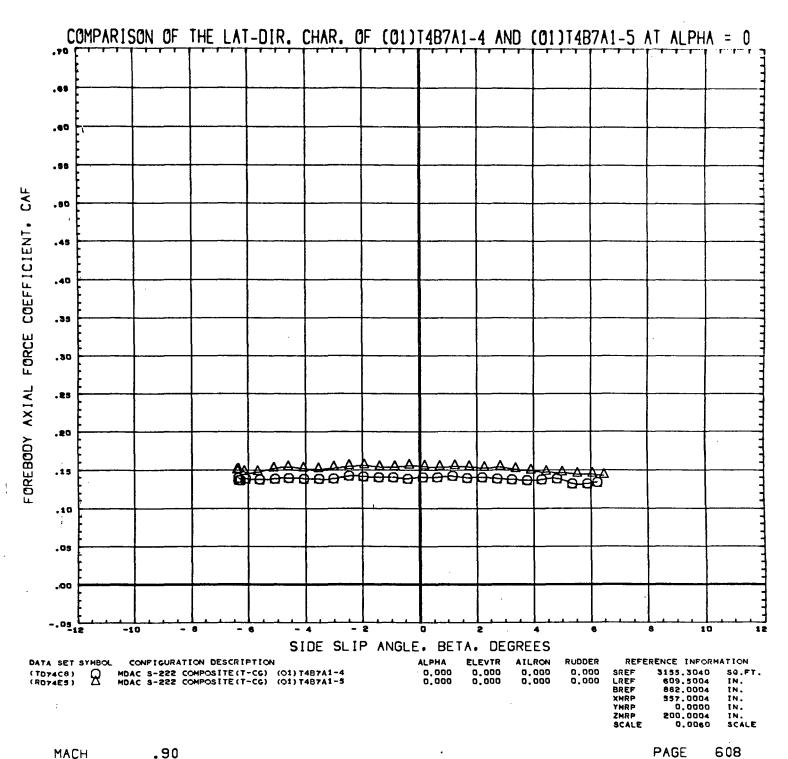




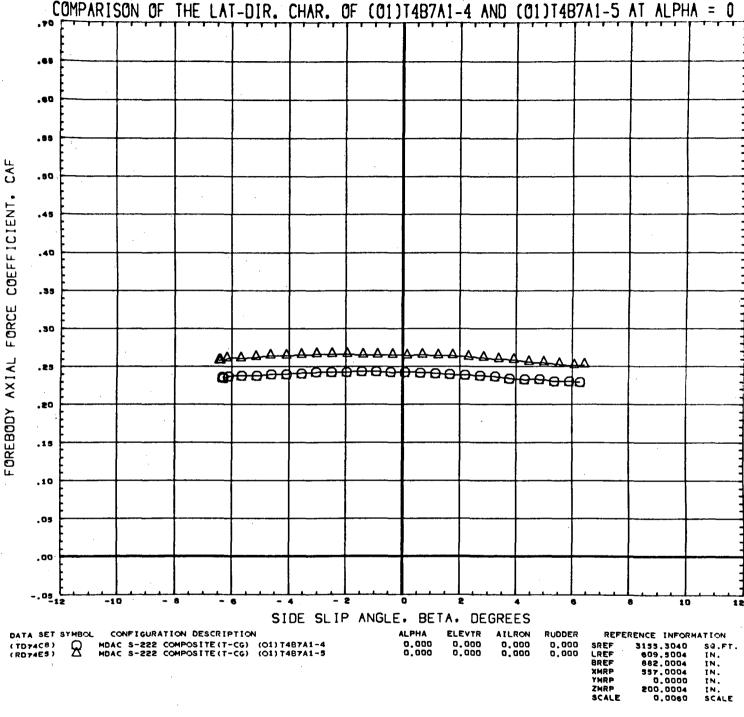
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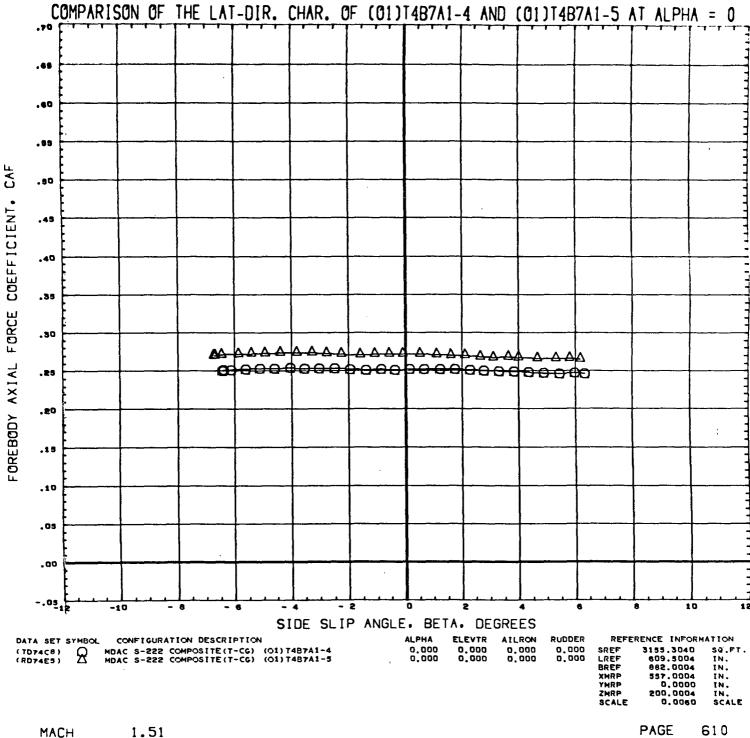


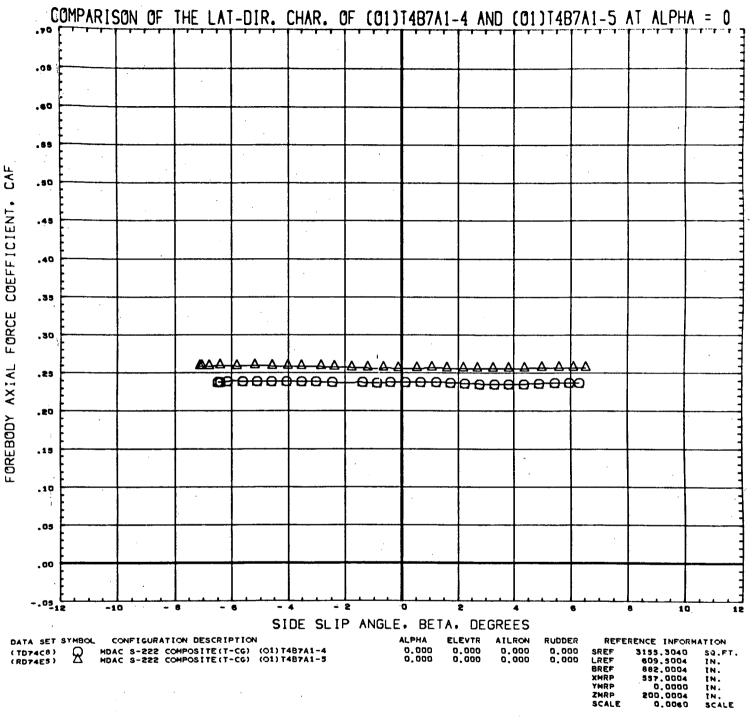


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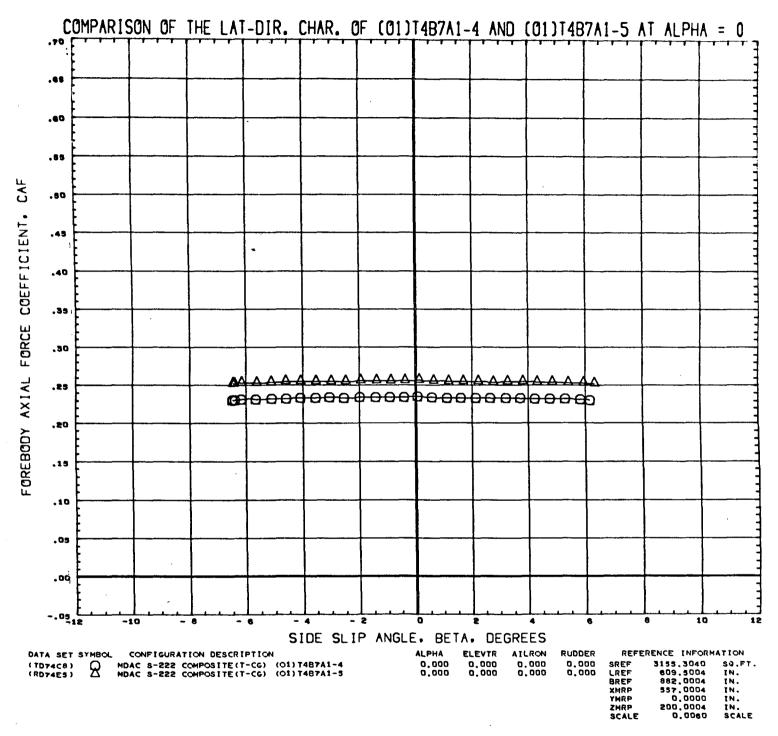


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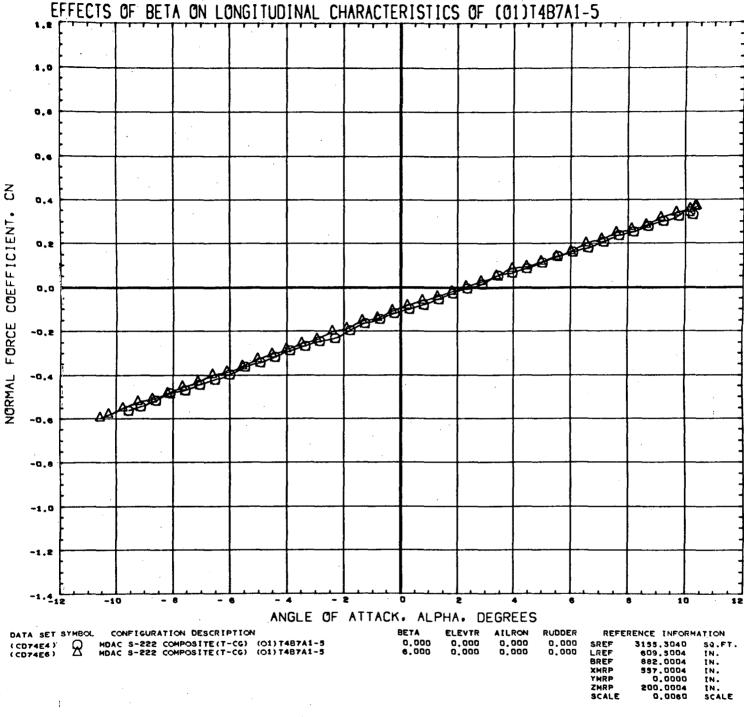


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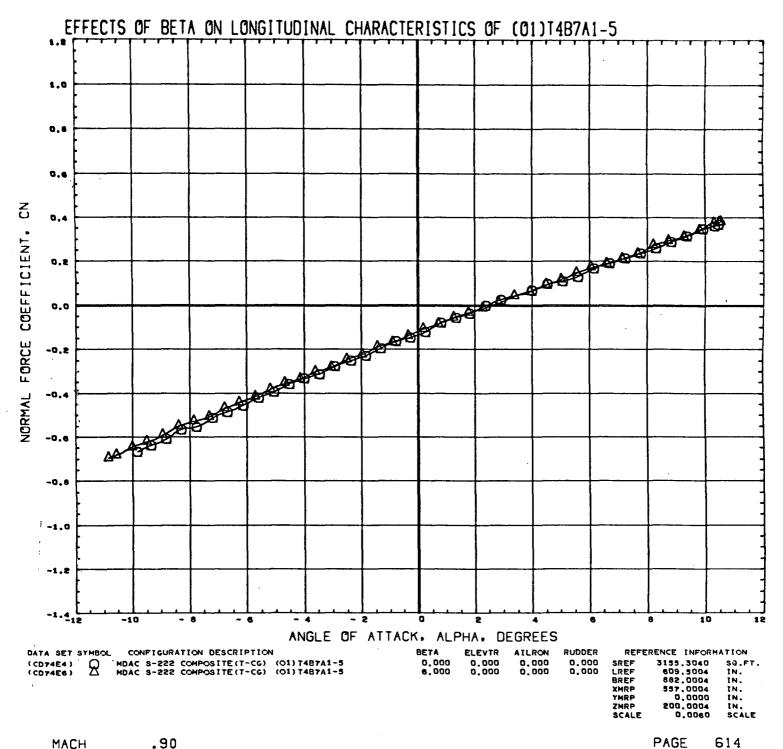


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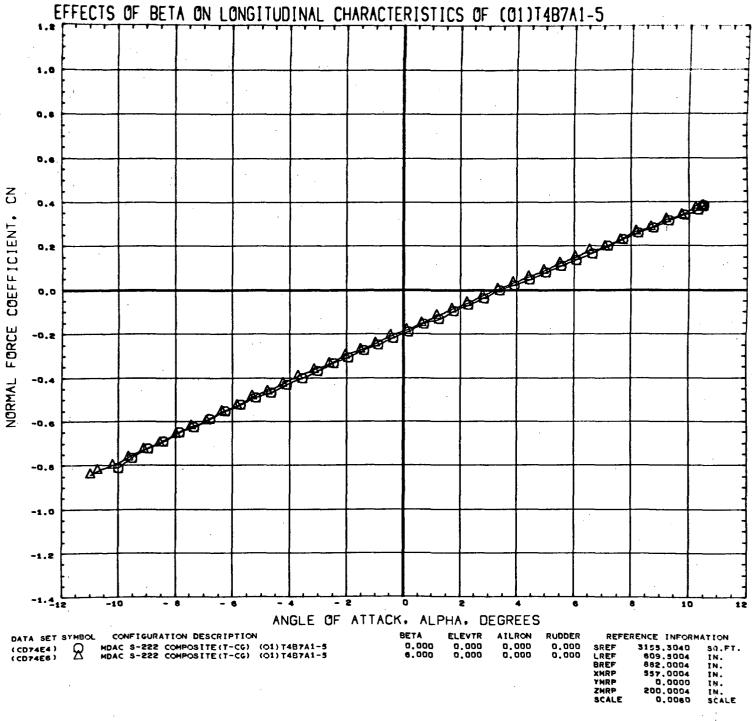
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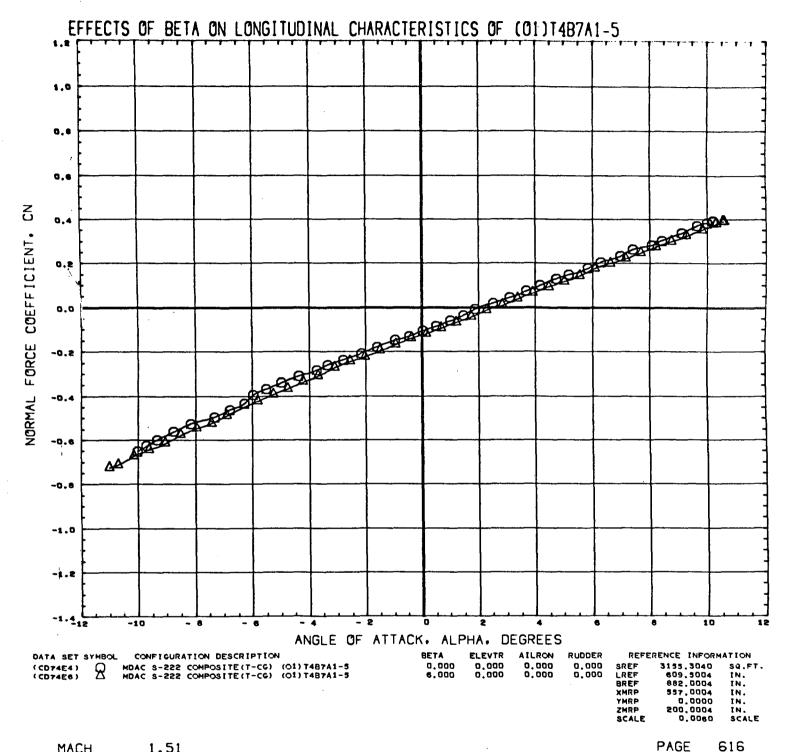
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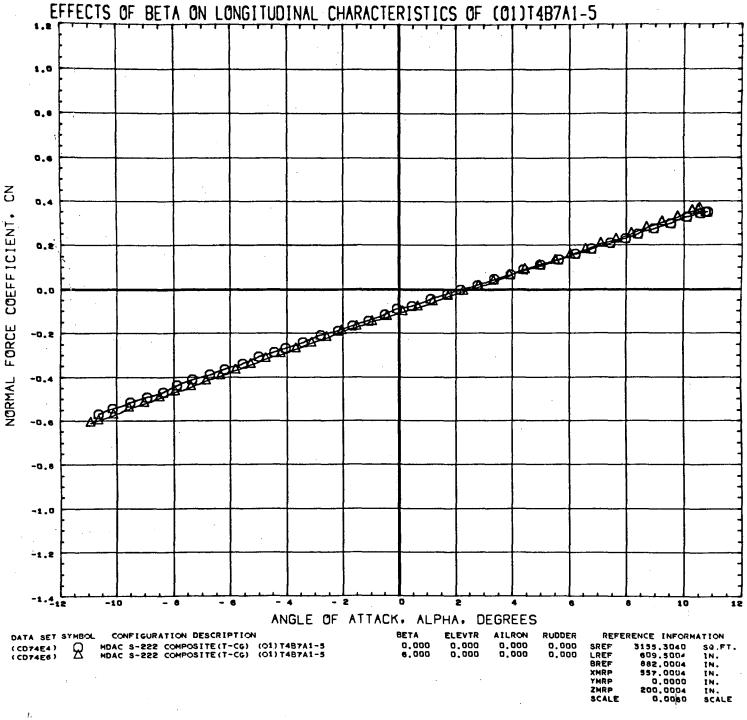
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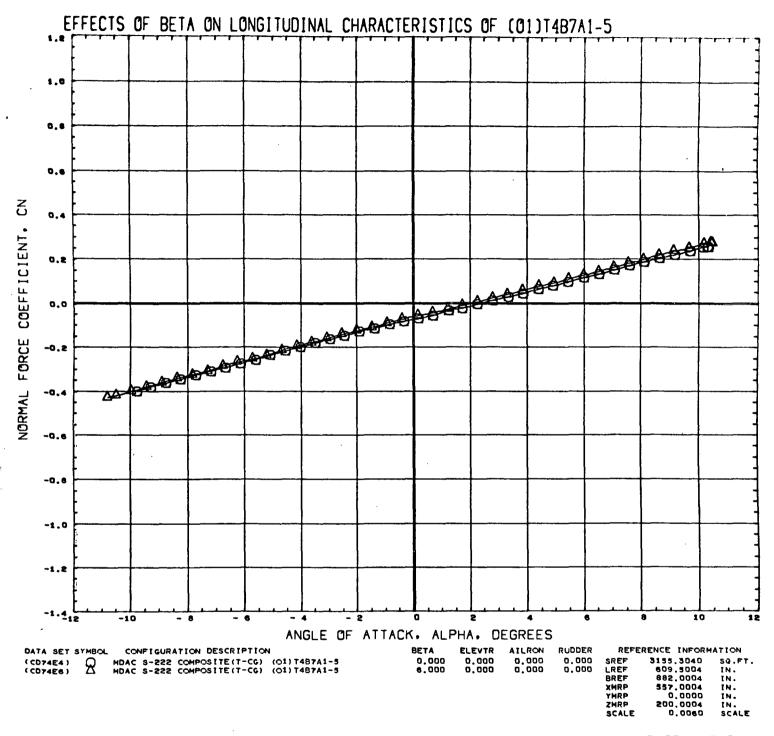
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MACH 2.20

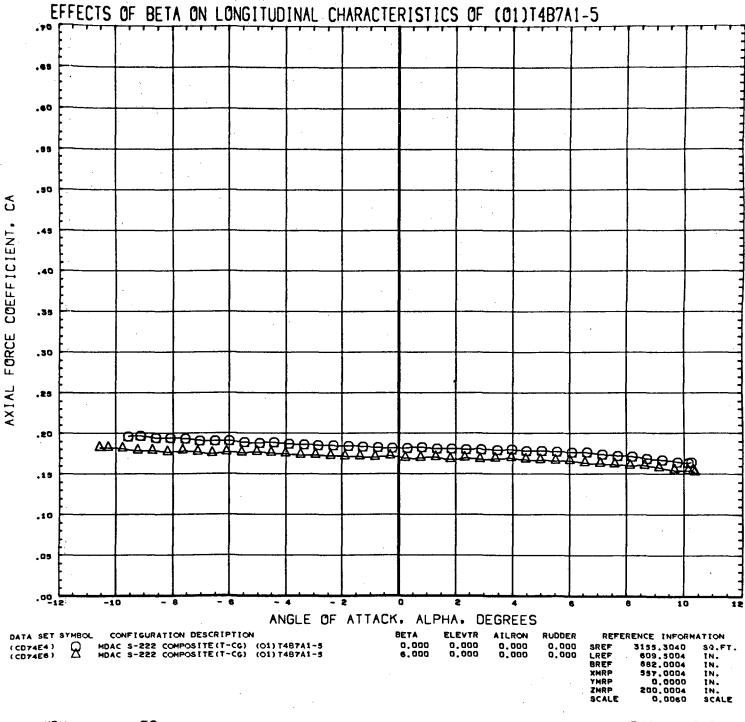


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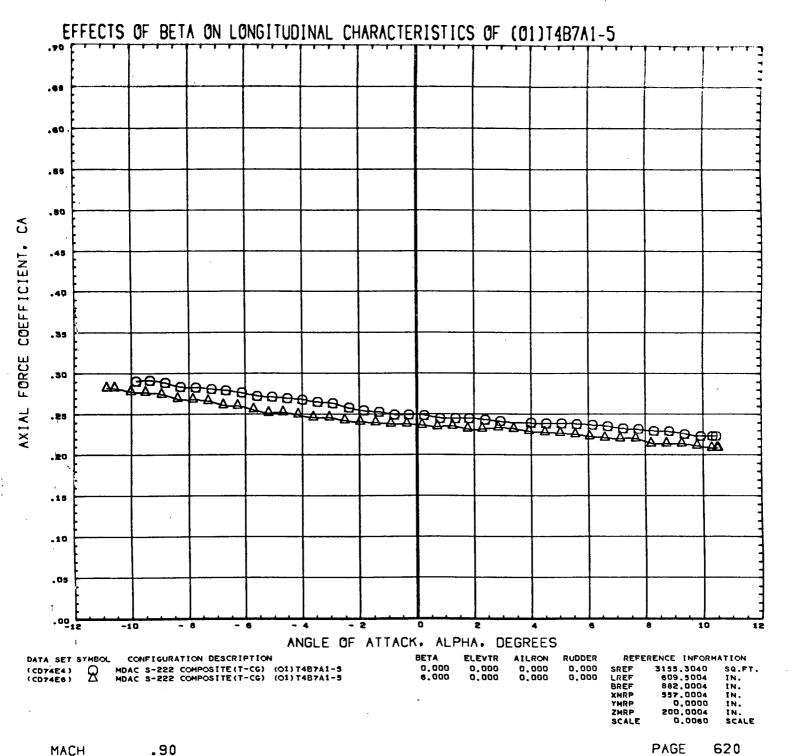
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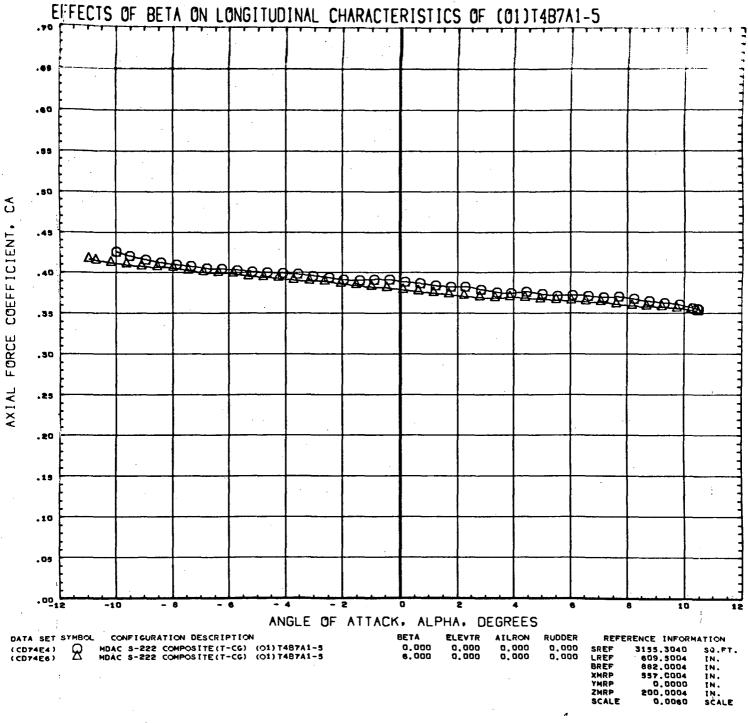
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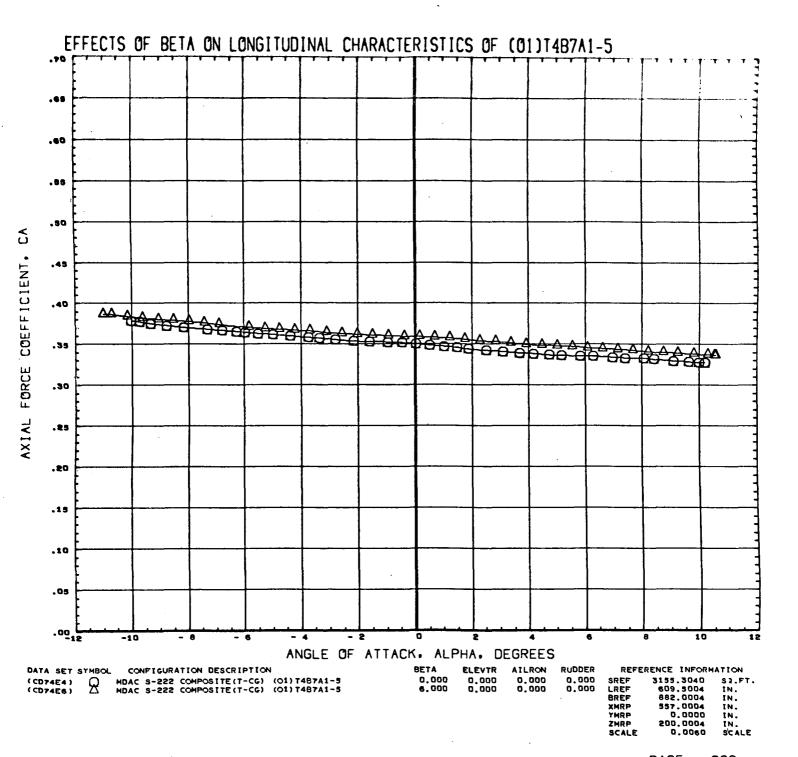


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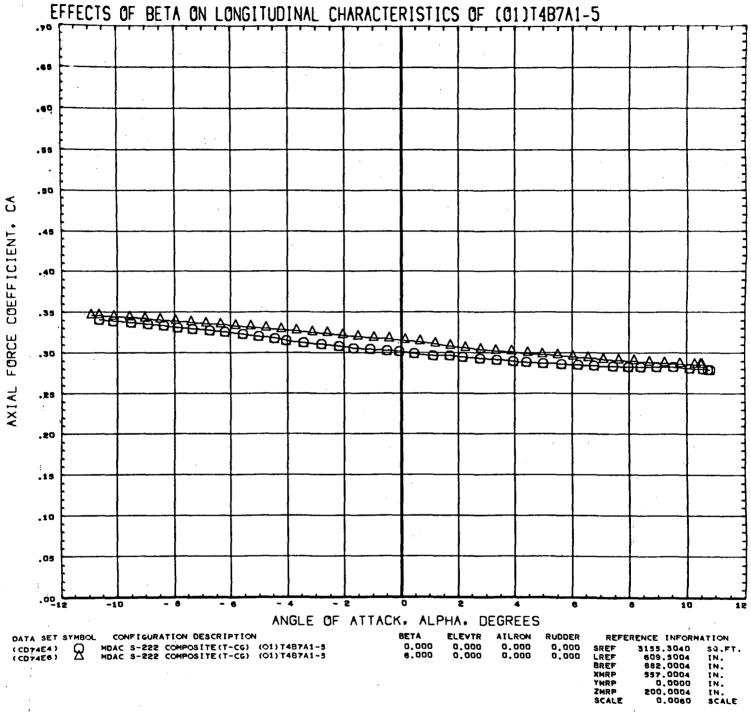




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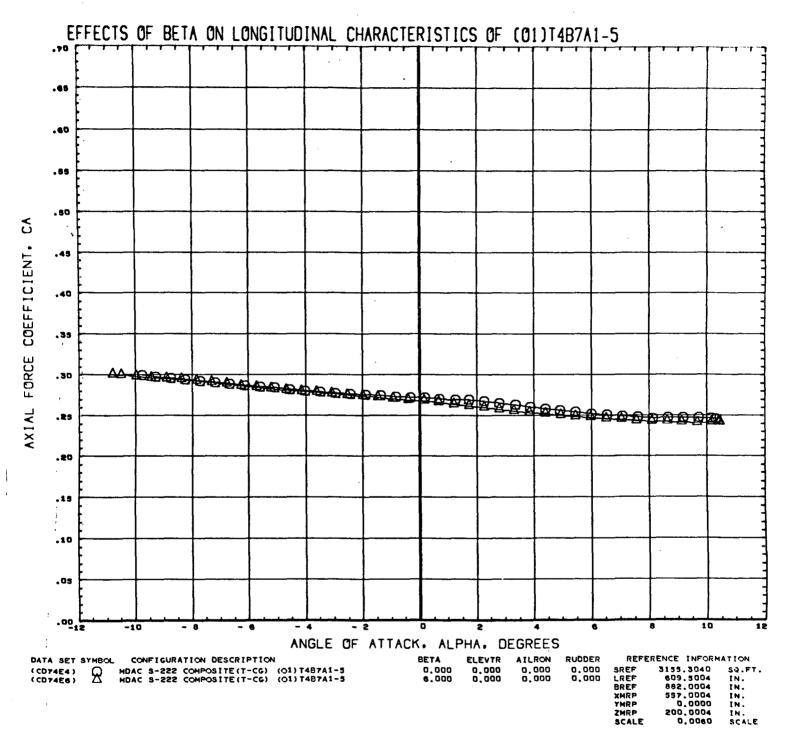
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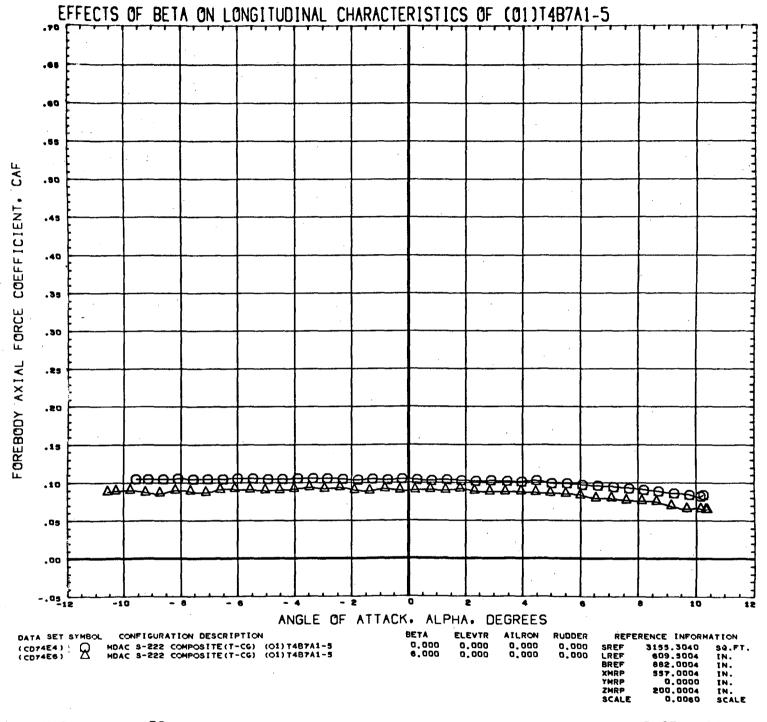
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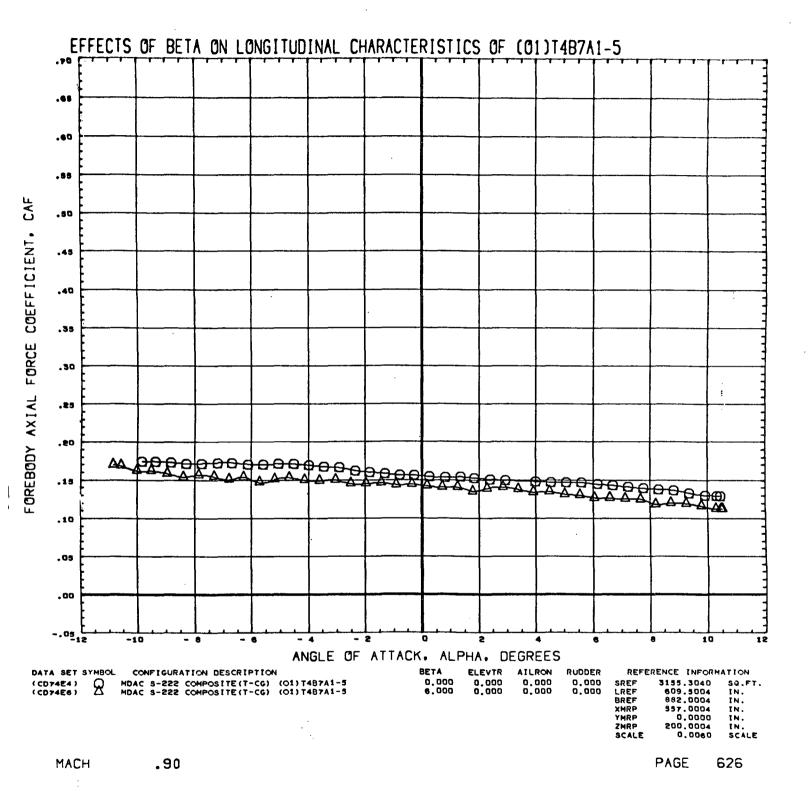


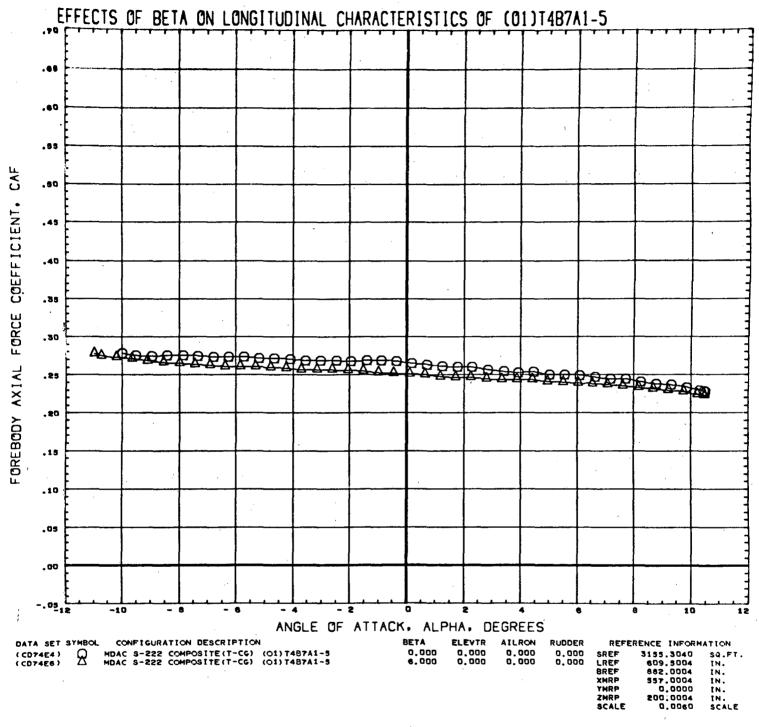
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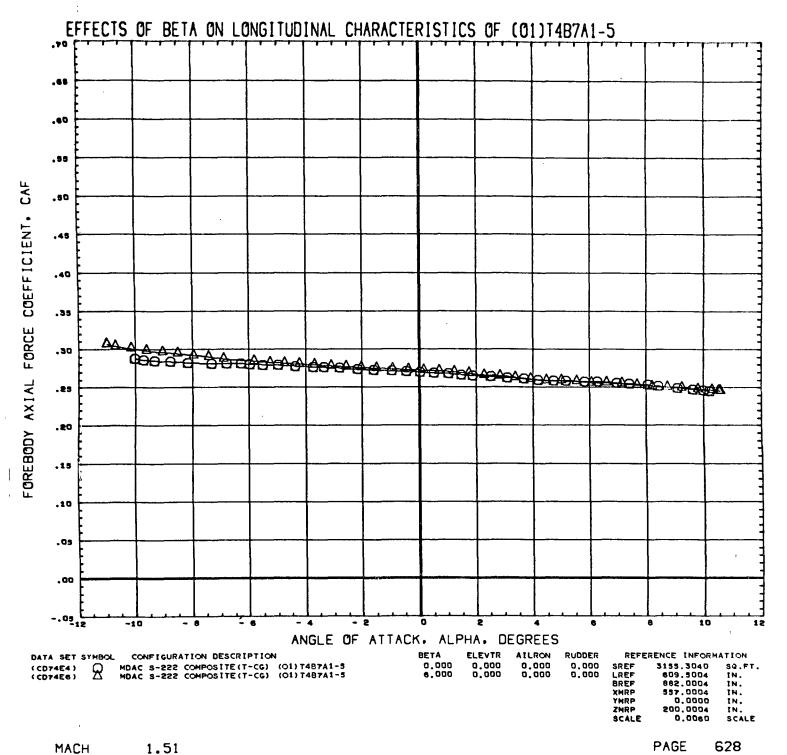


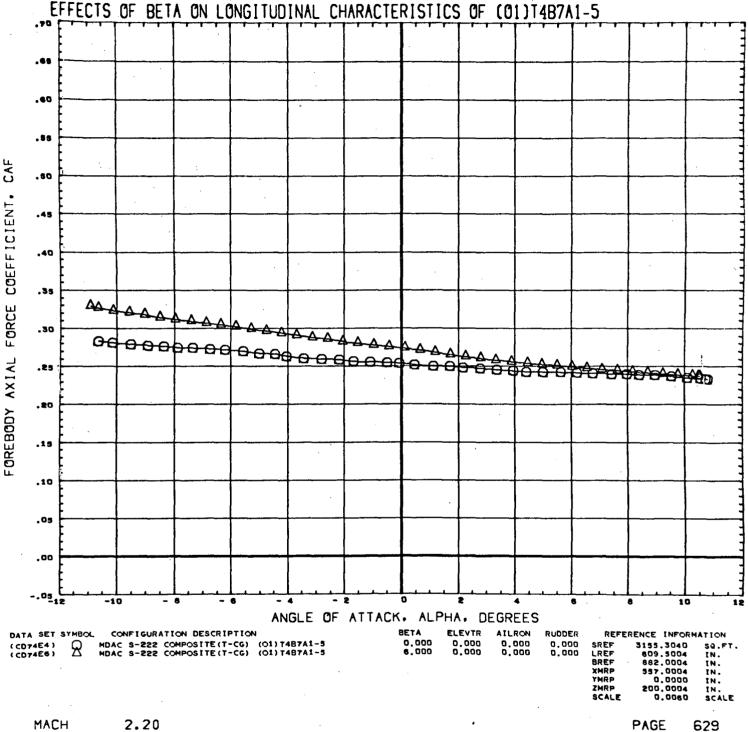


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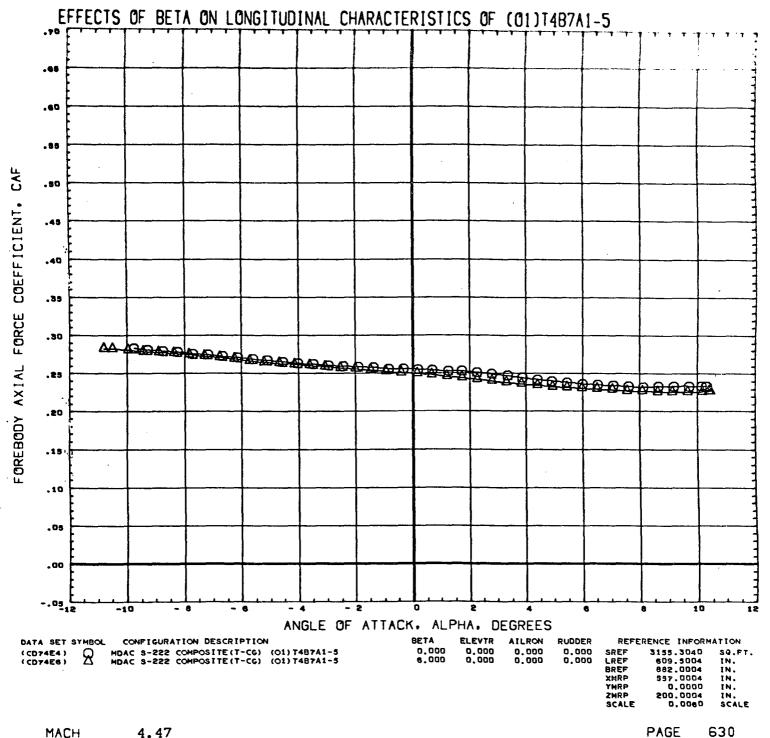
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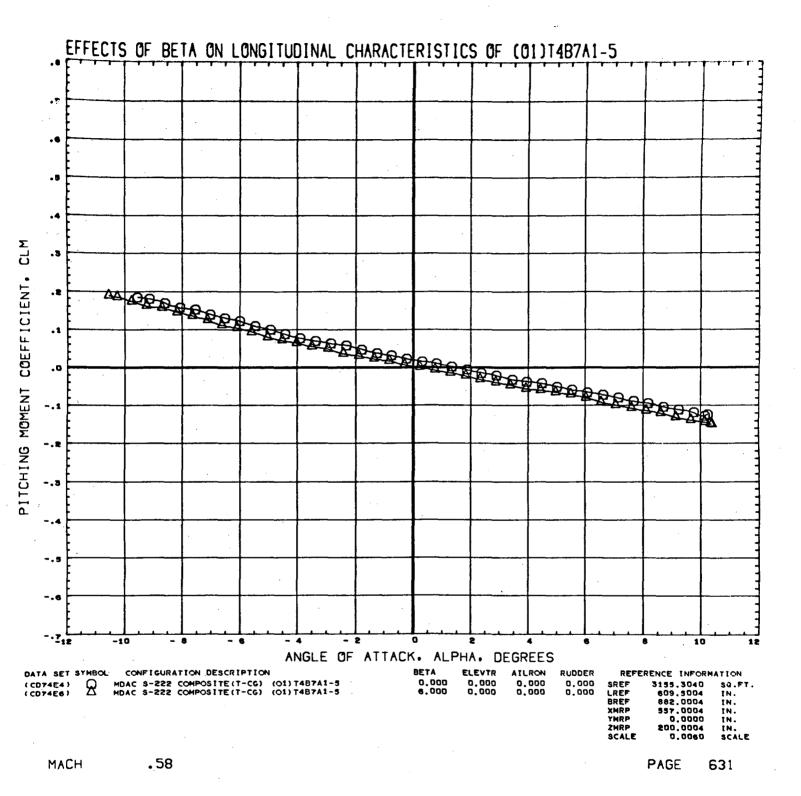
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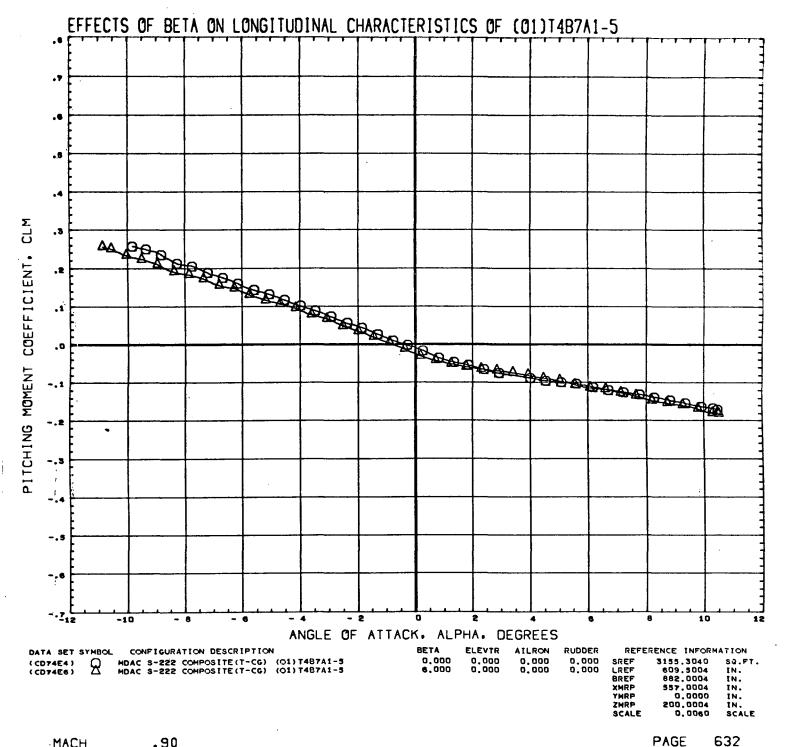




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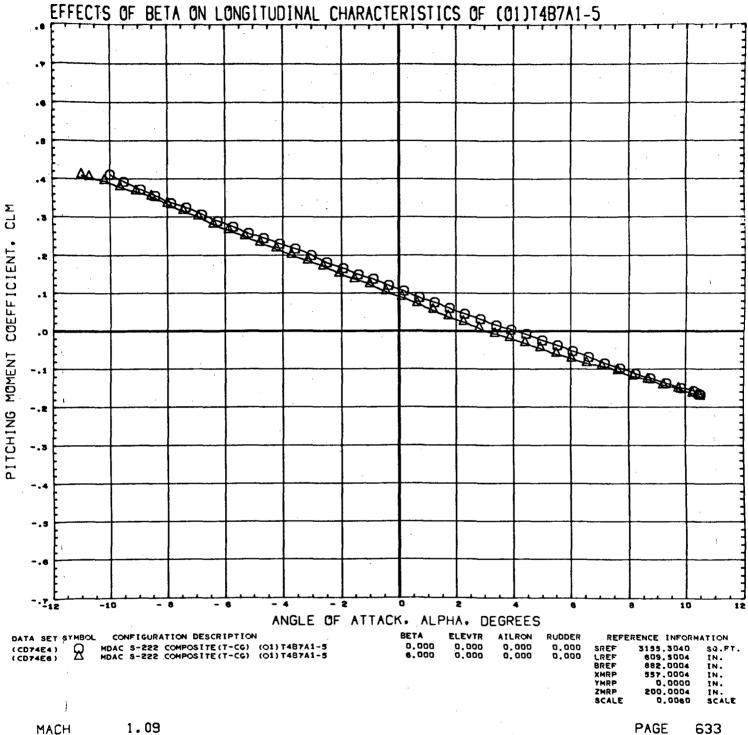




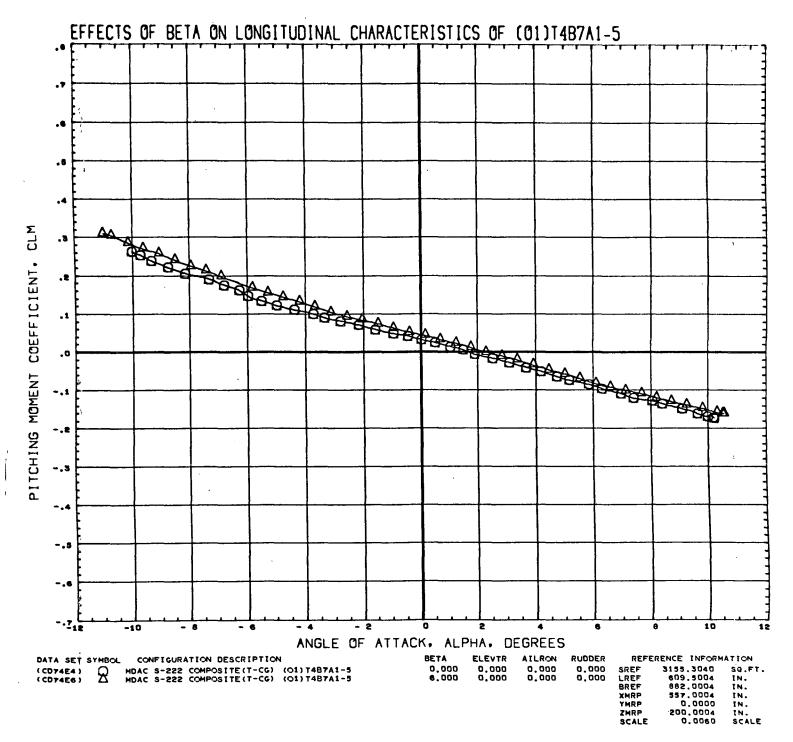


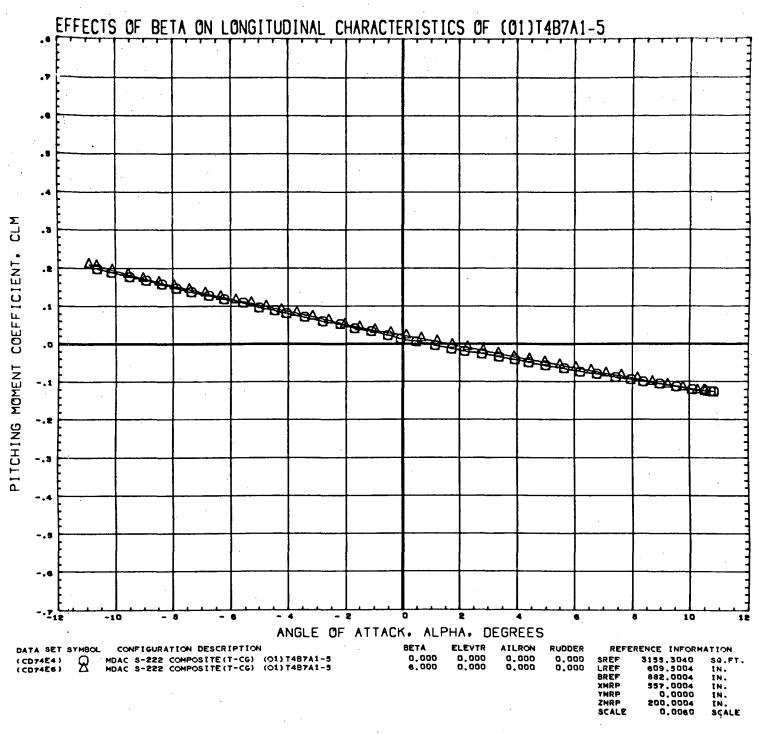
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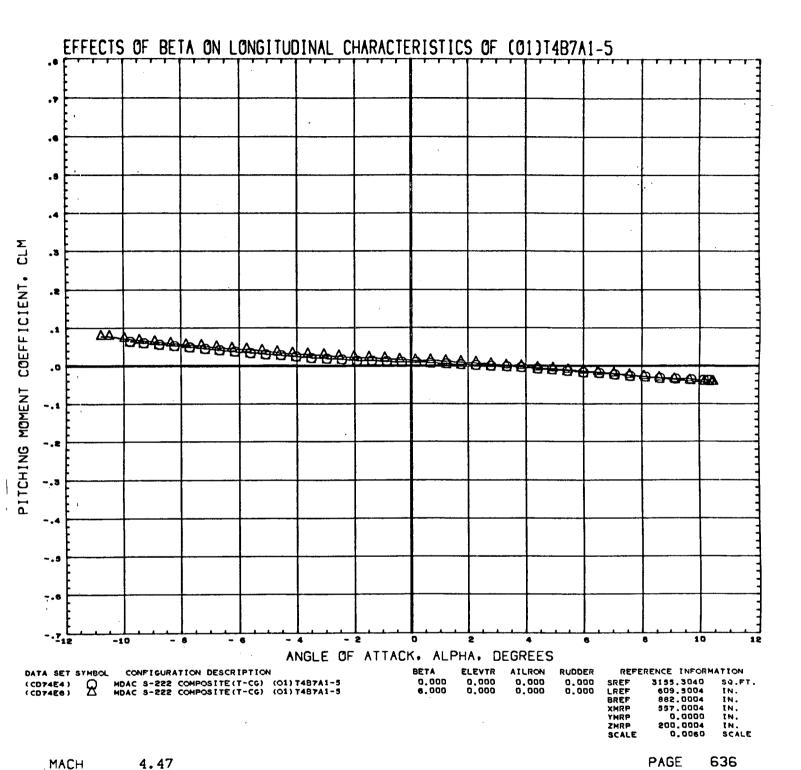


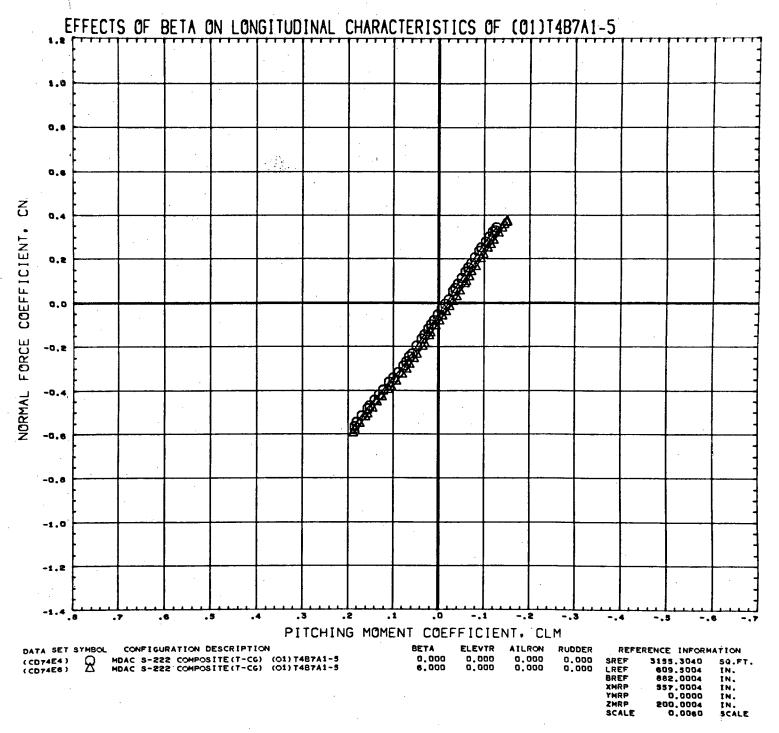
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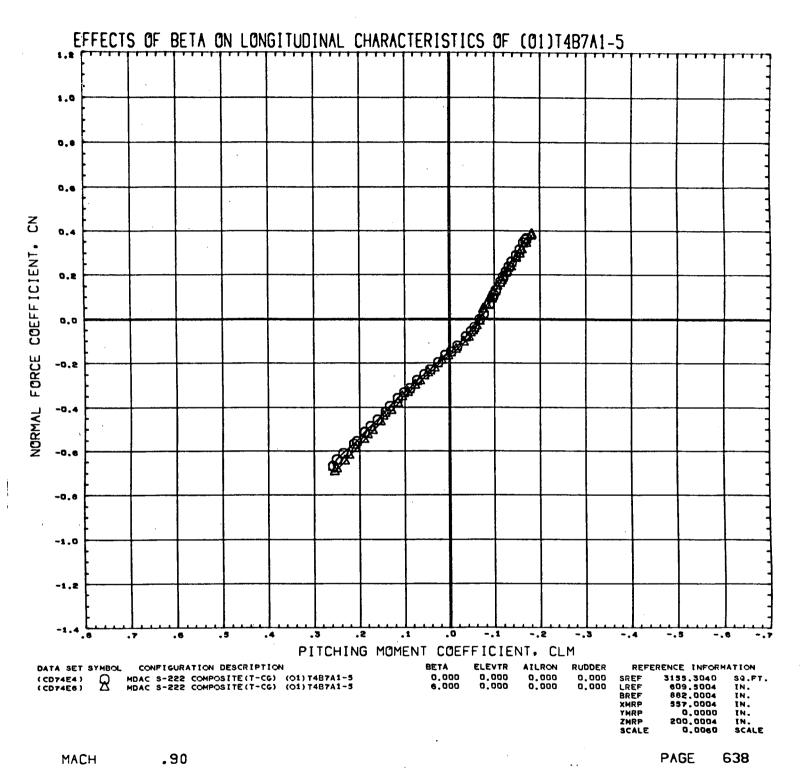


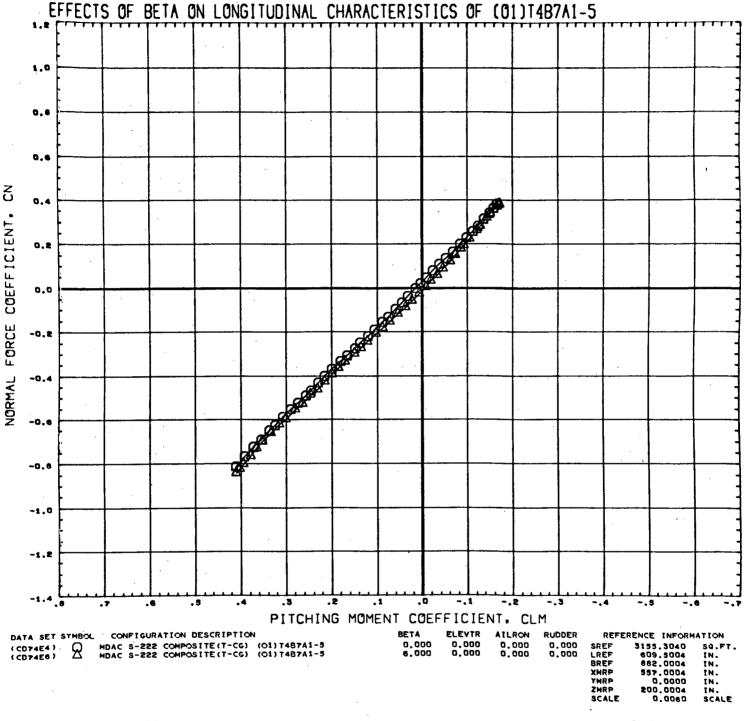
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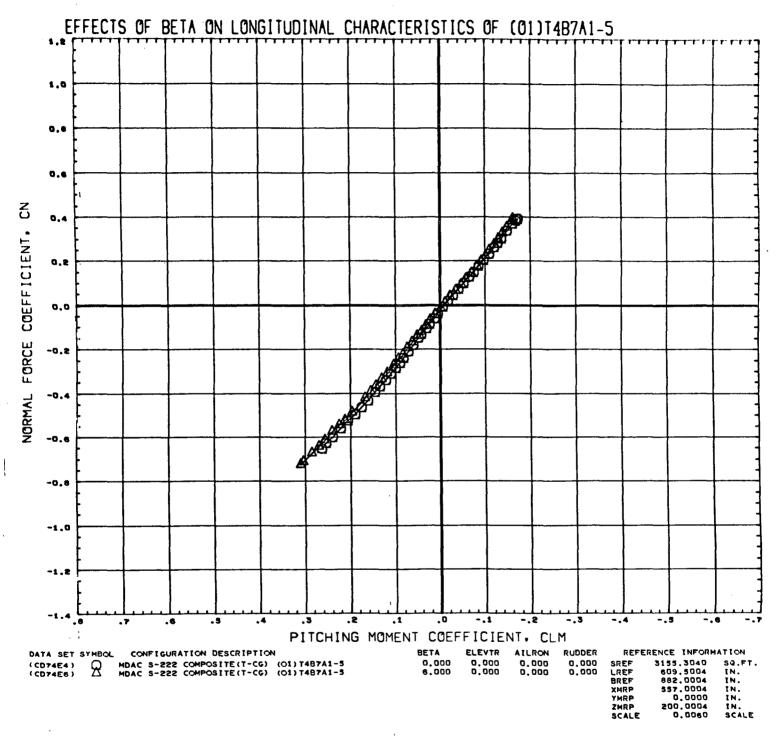


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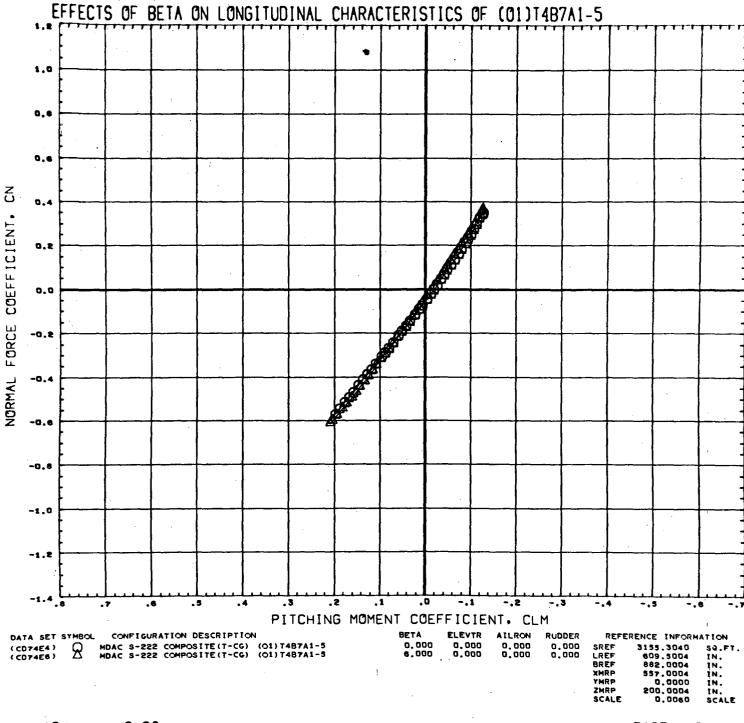


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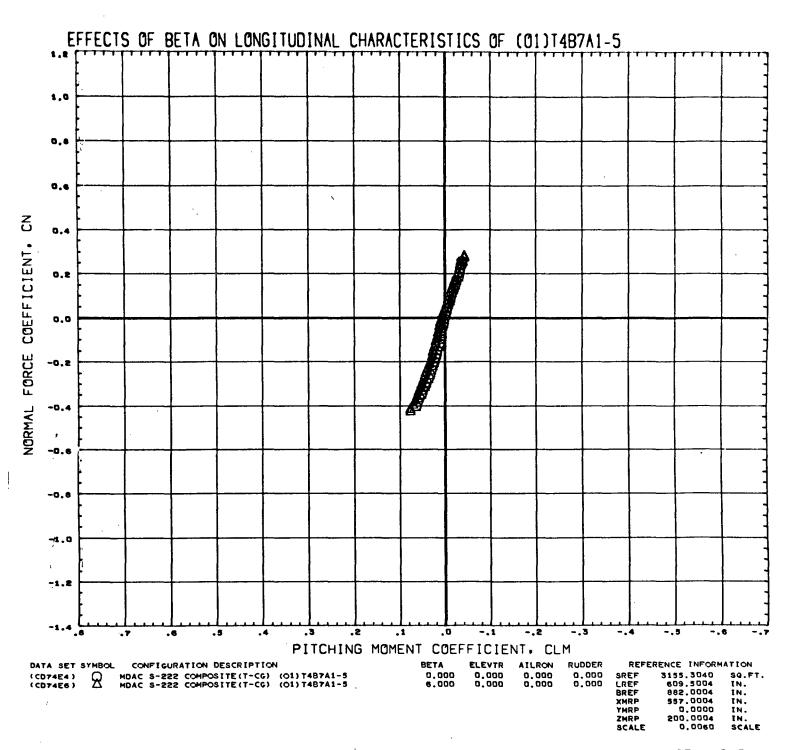


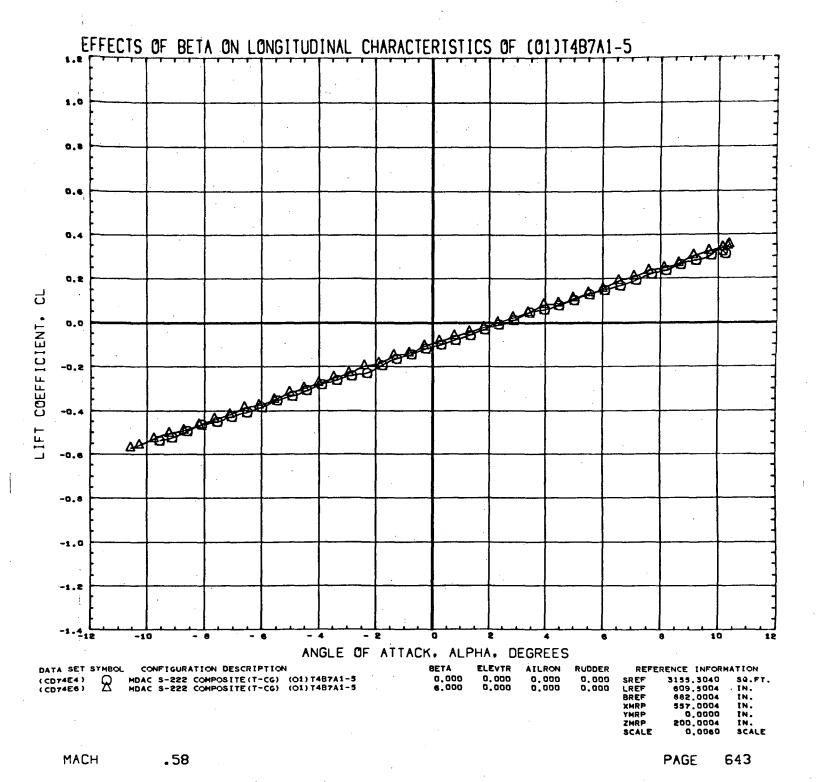
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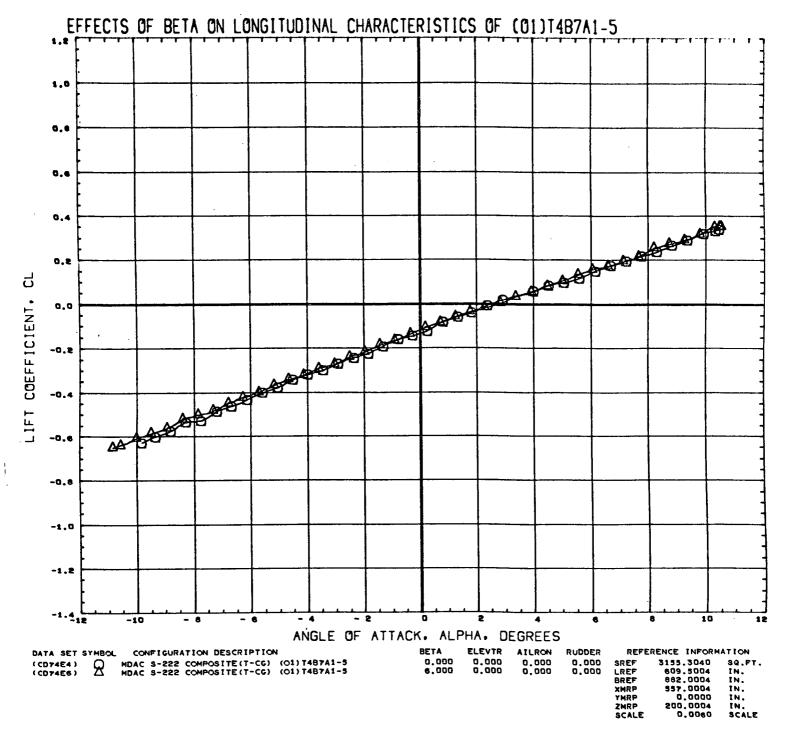


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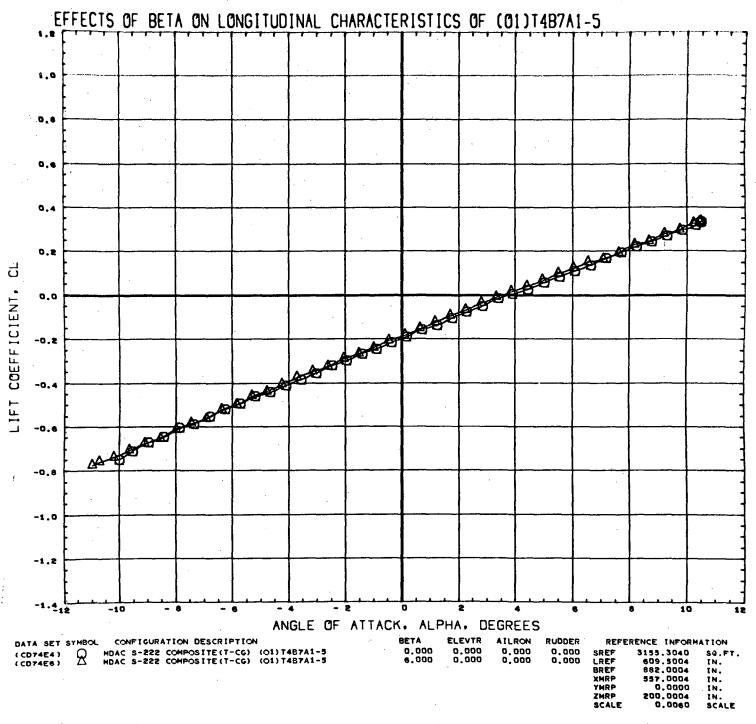


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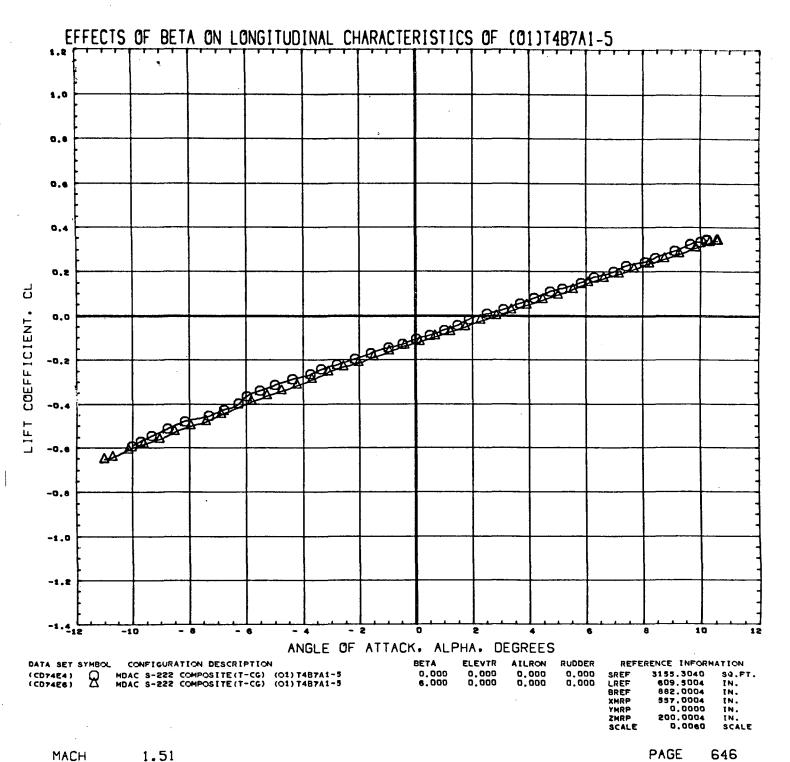


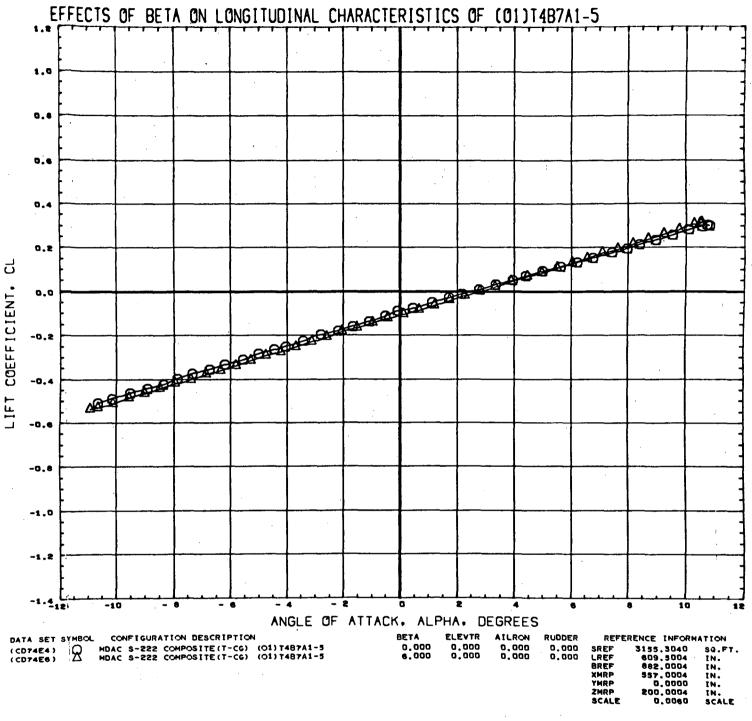
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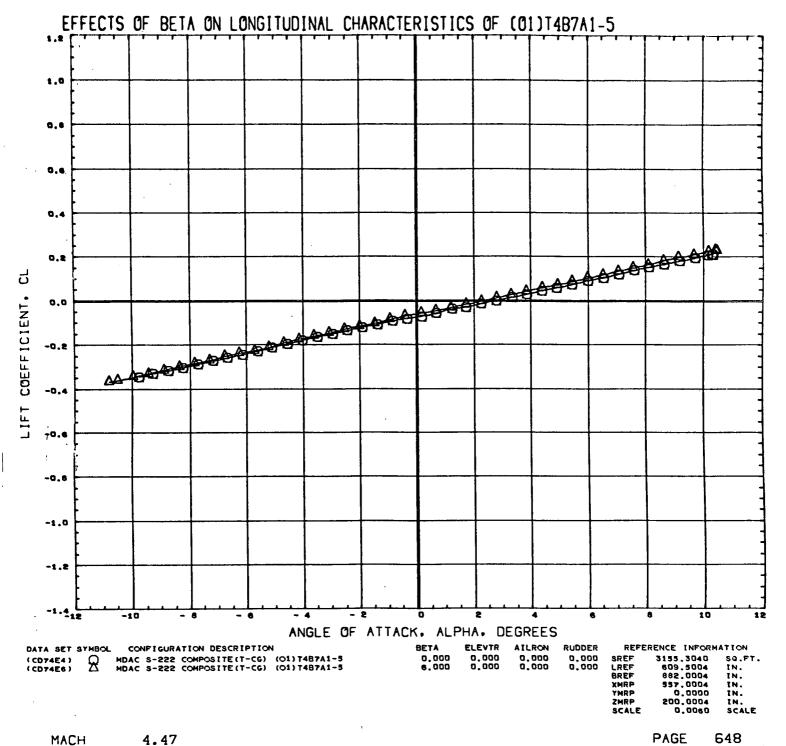


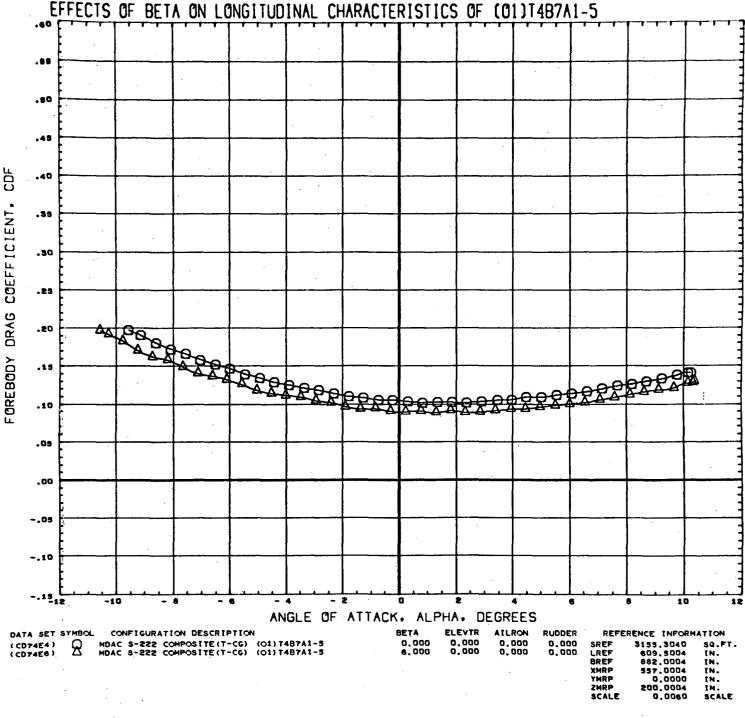
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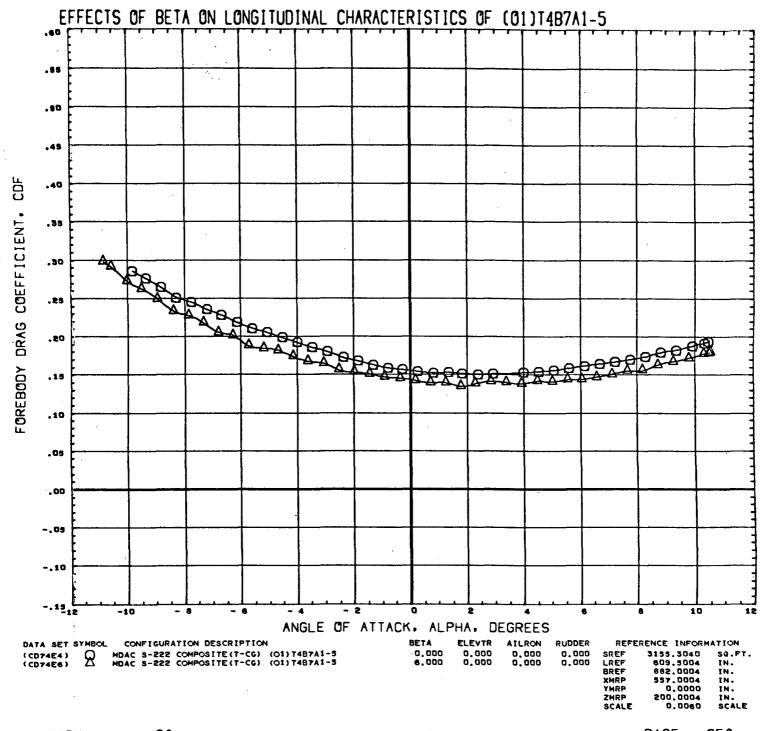


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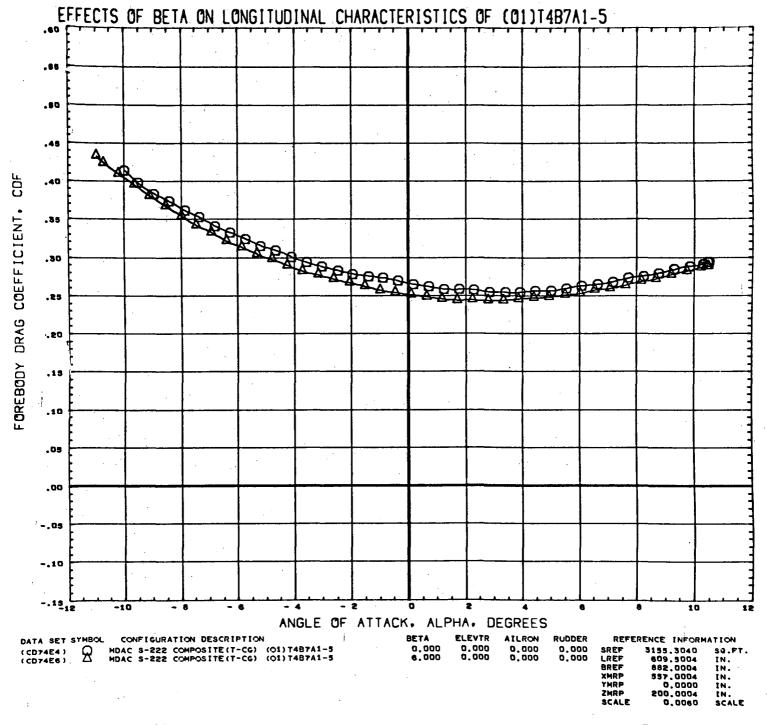




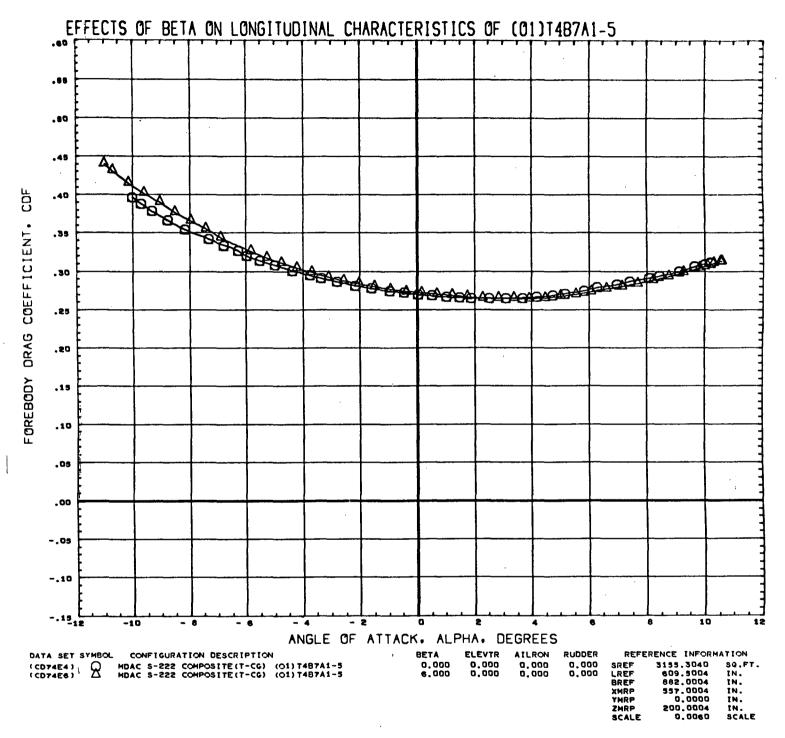
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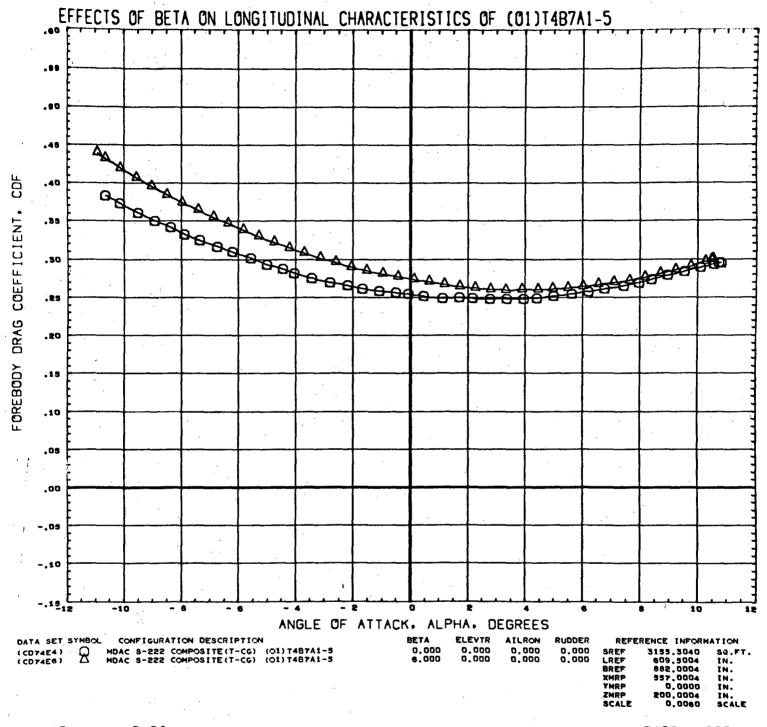
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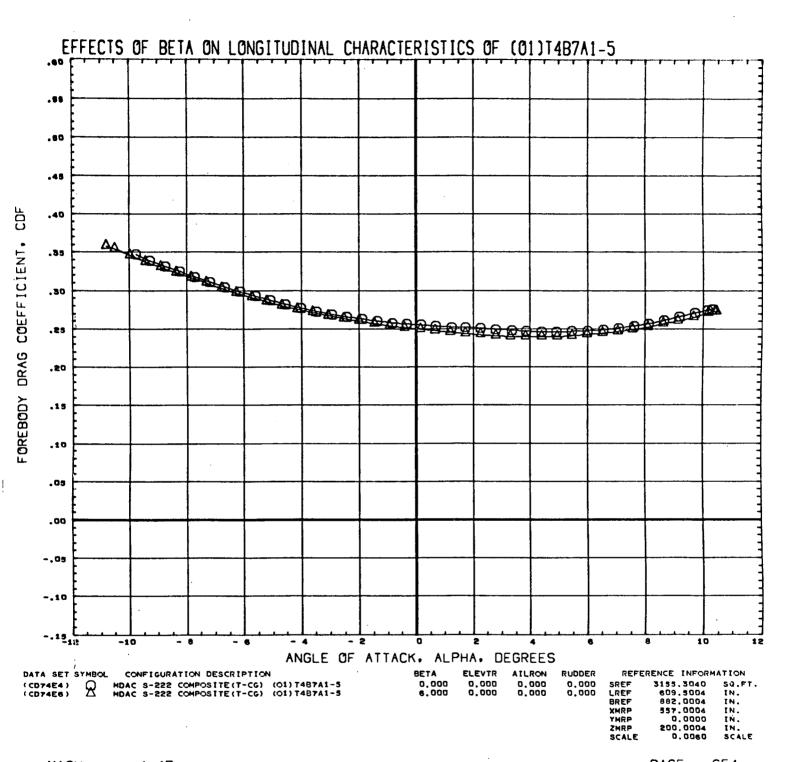
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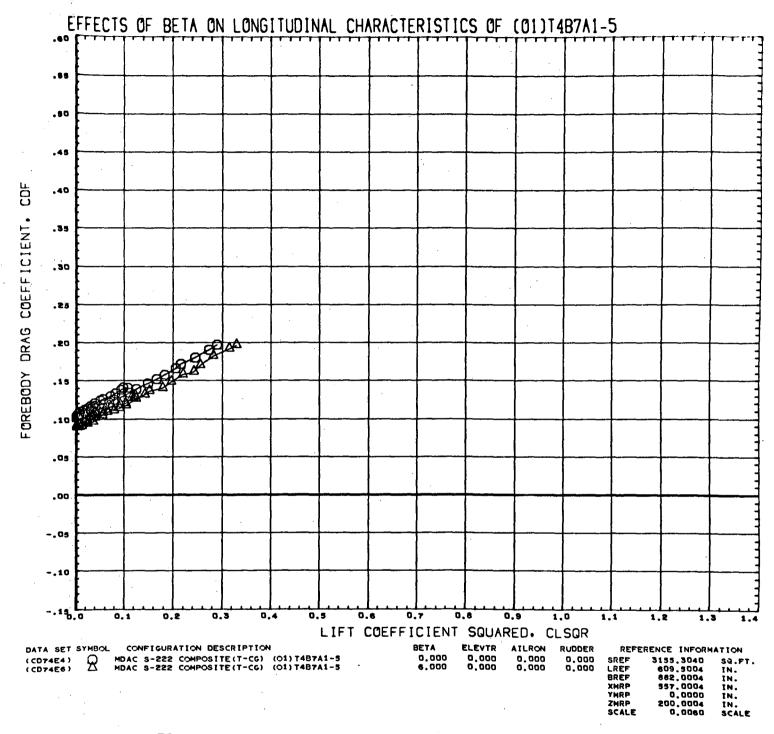
MACH 1.51



MACH 2.20

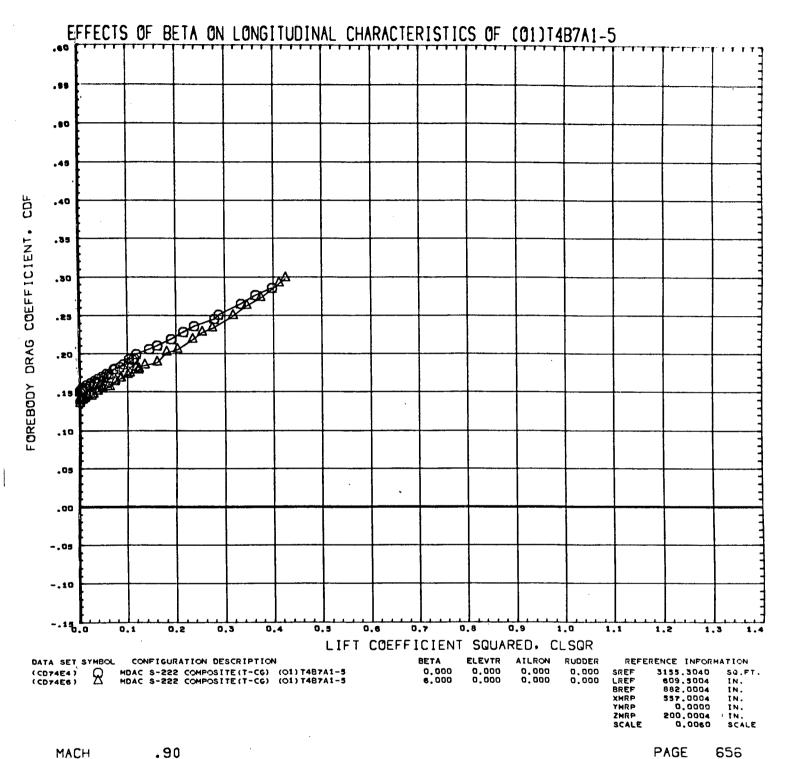


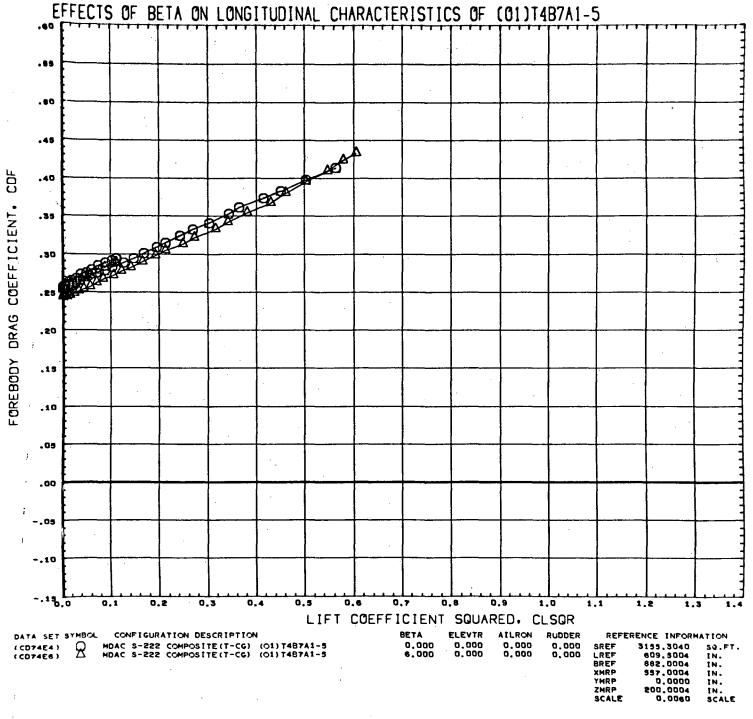
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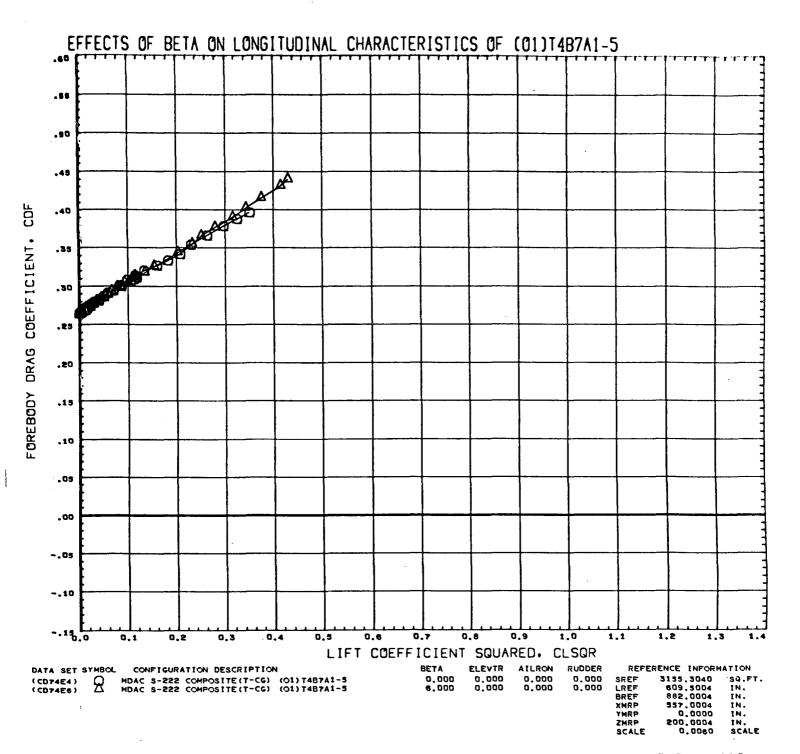
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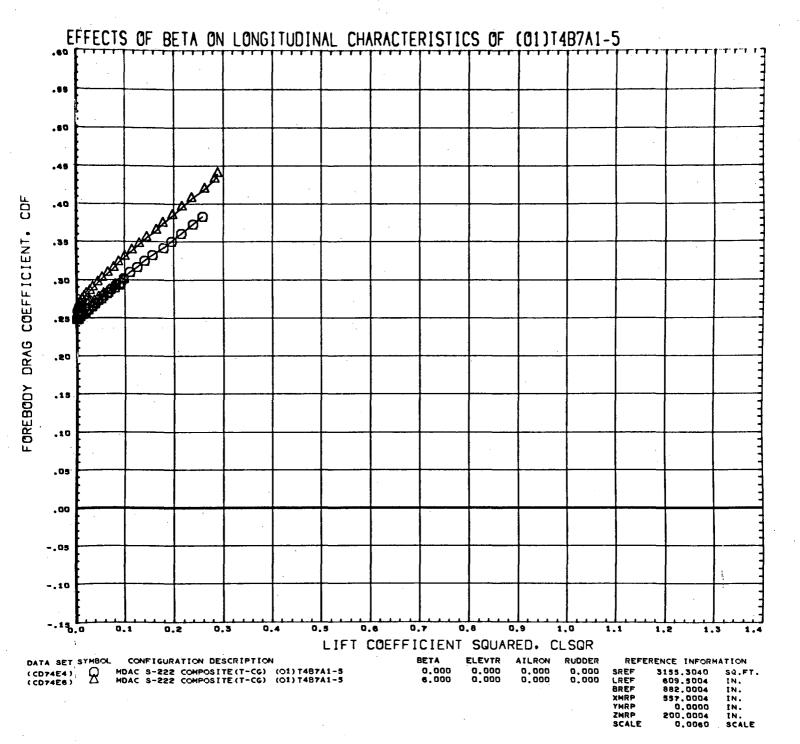
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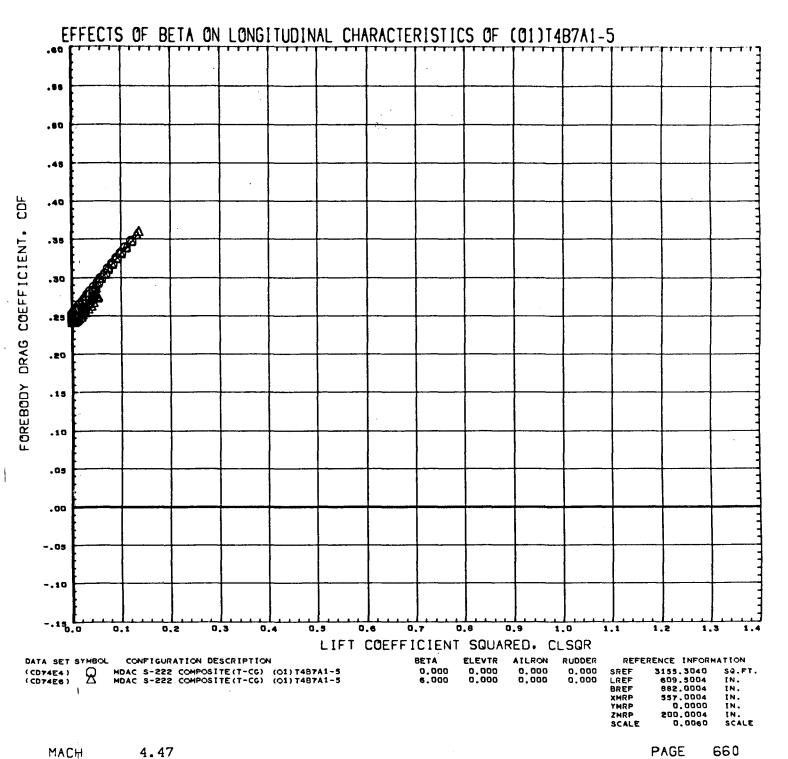


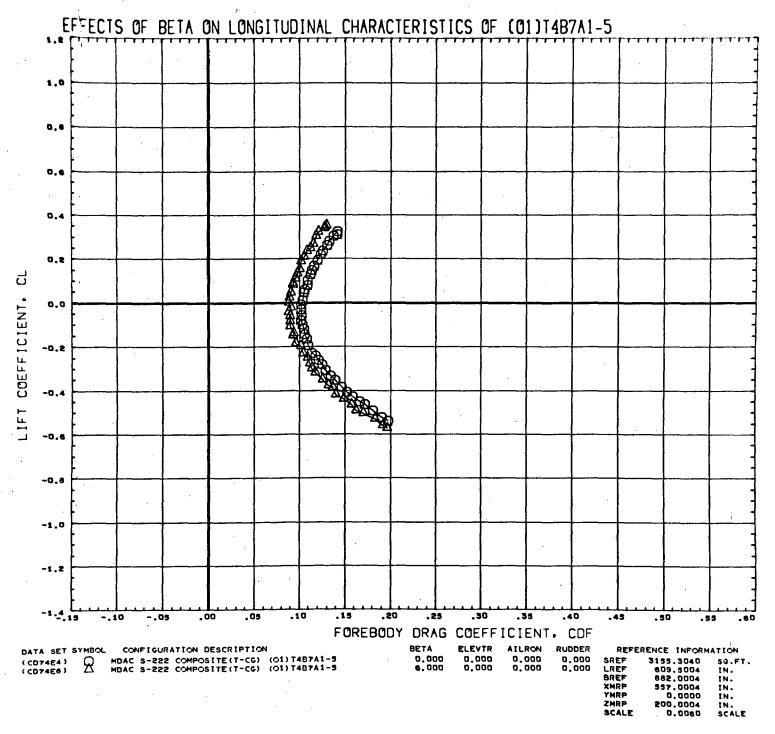
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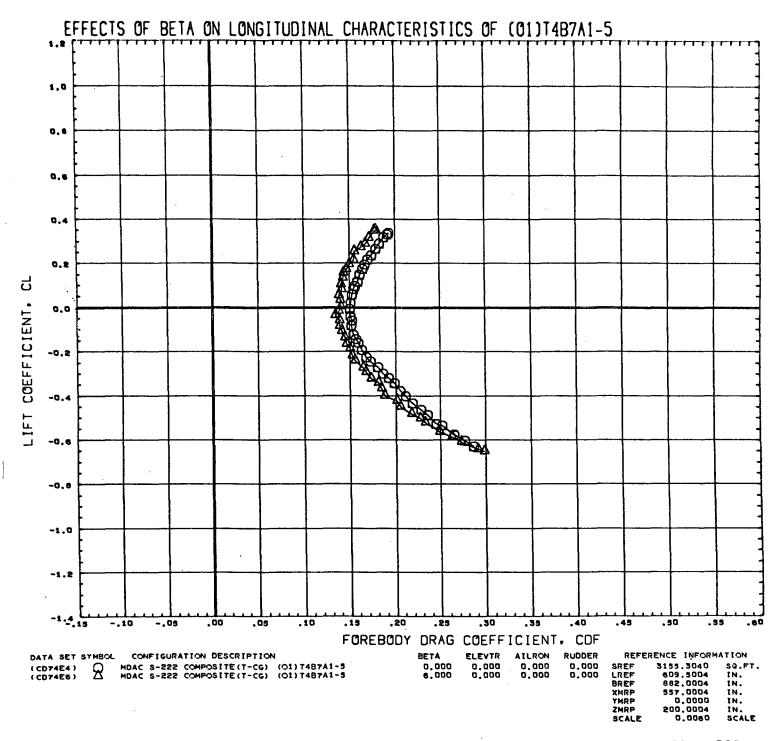


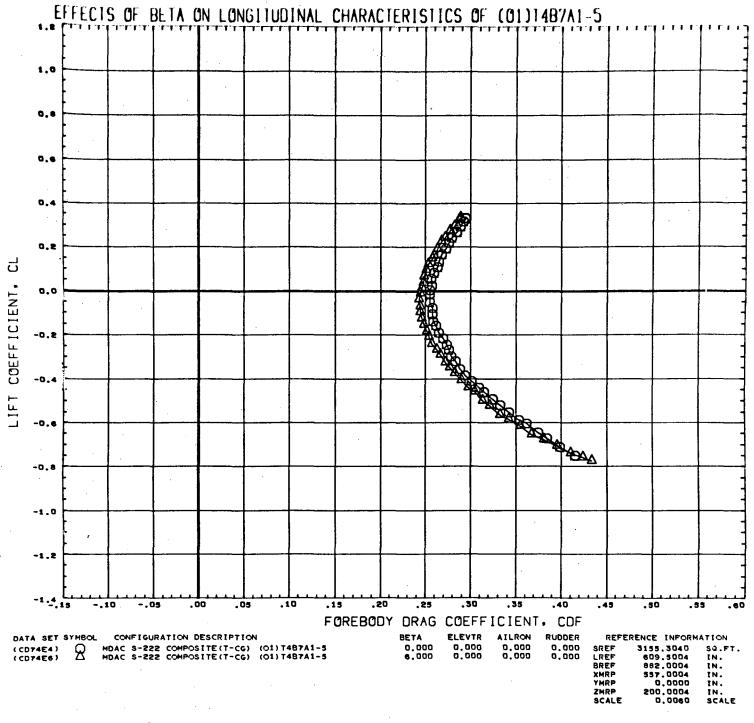
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MACH .58



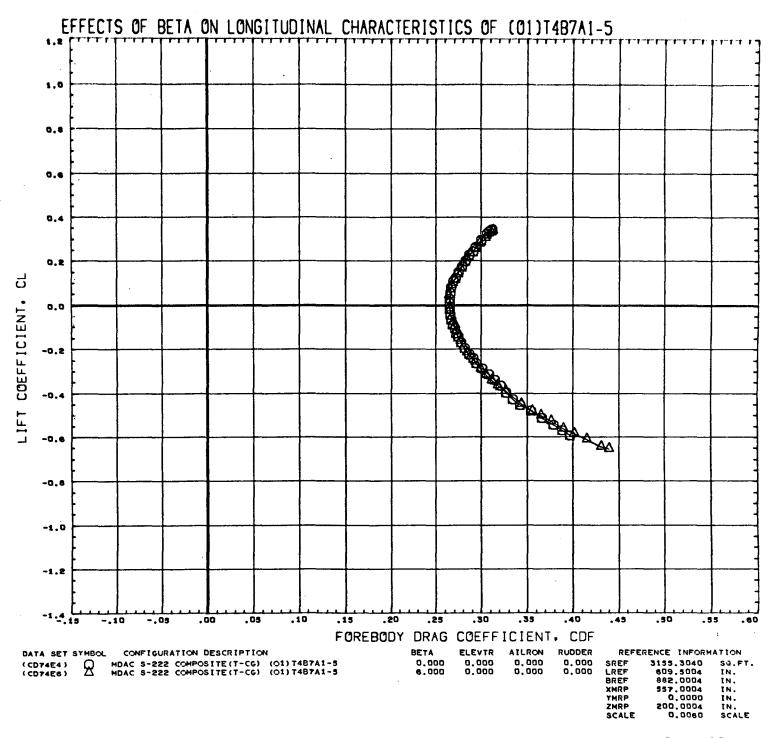


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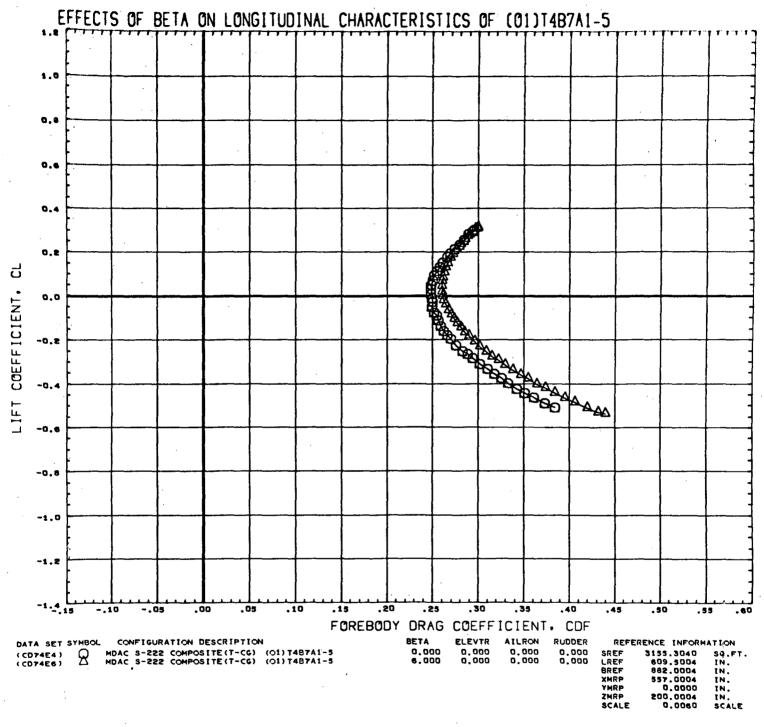
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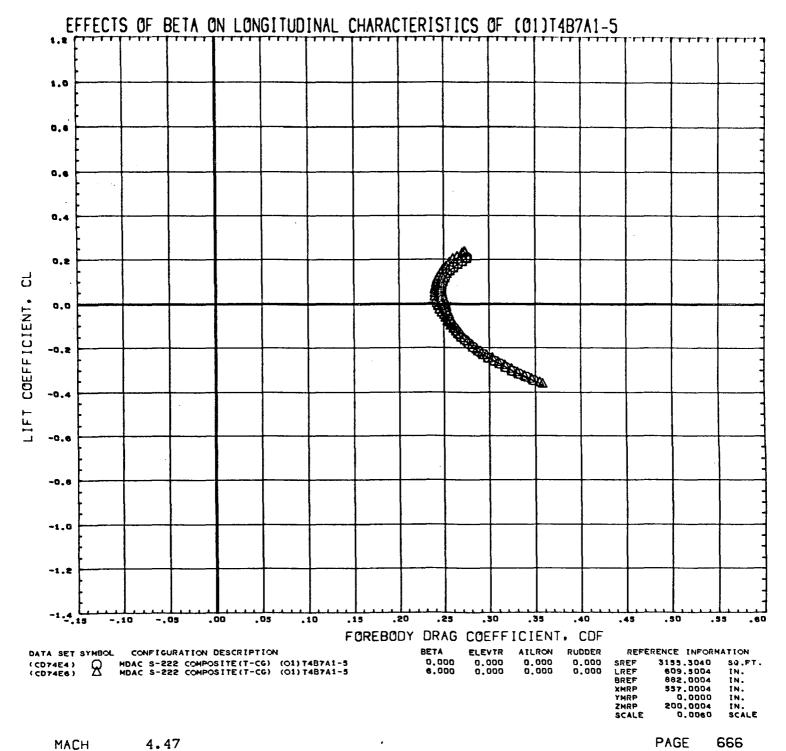
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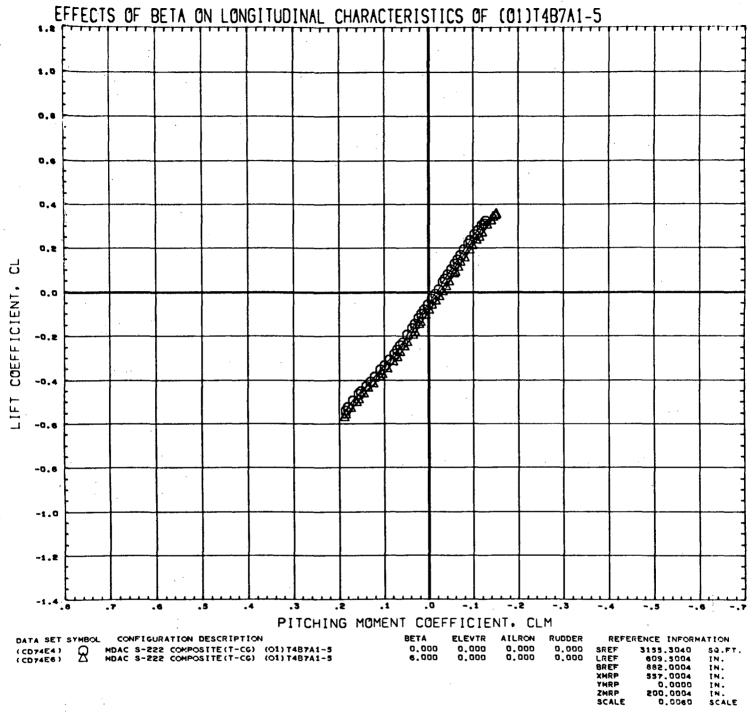


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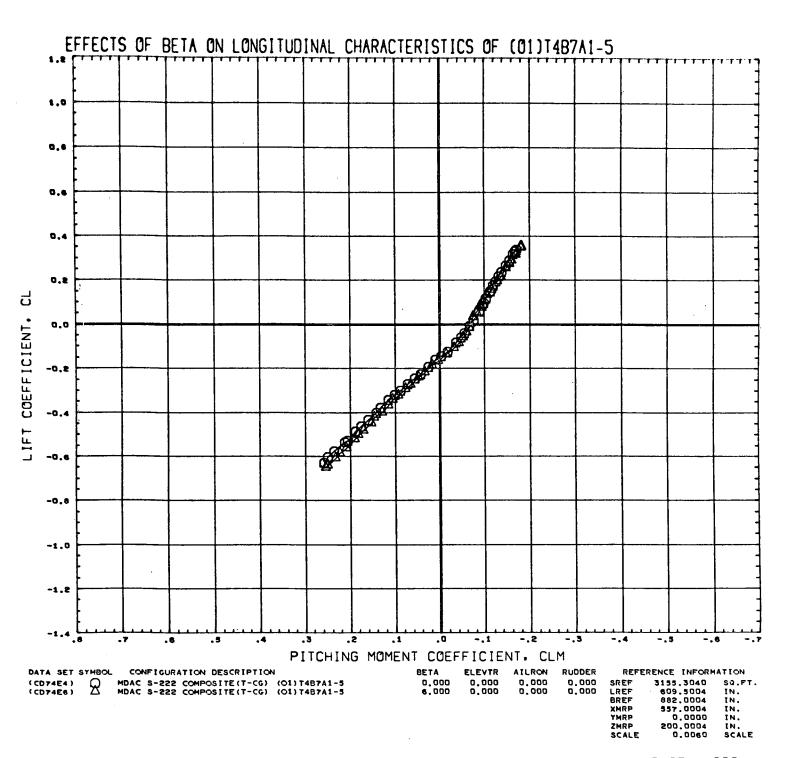




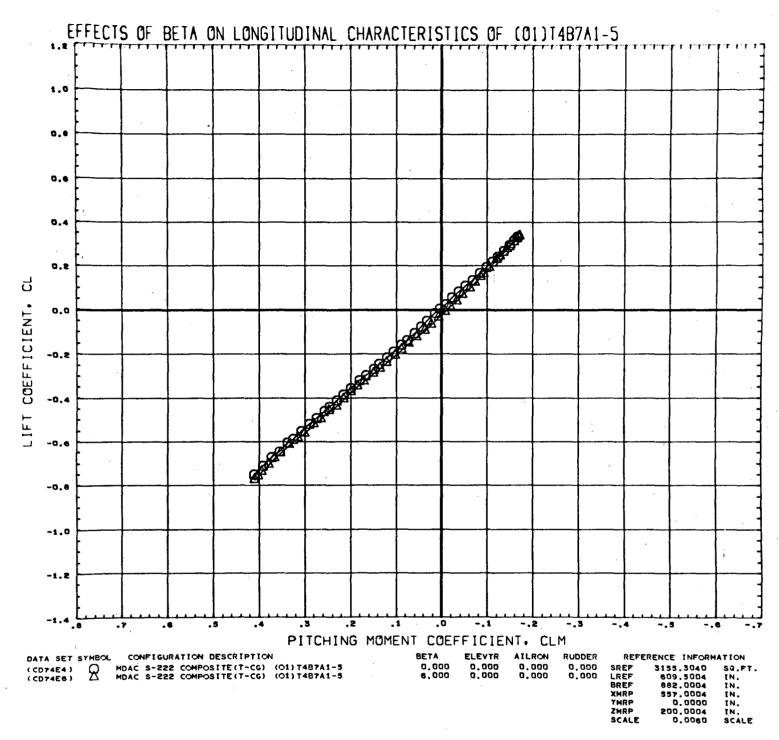
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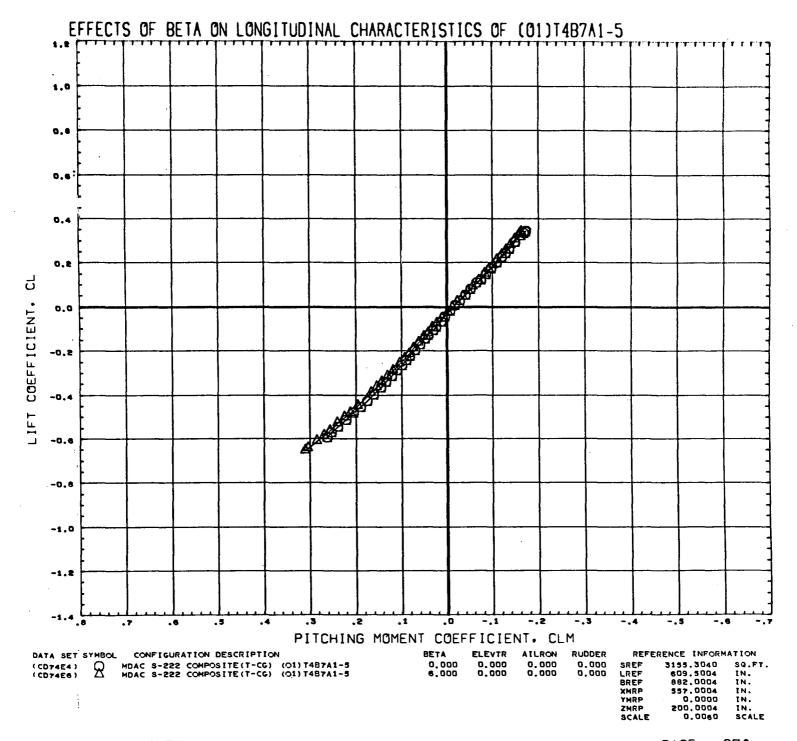
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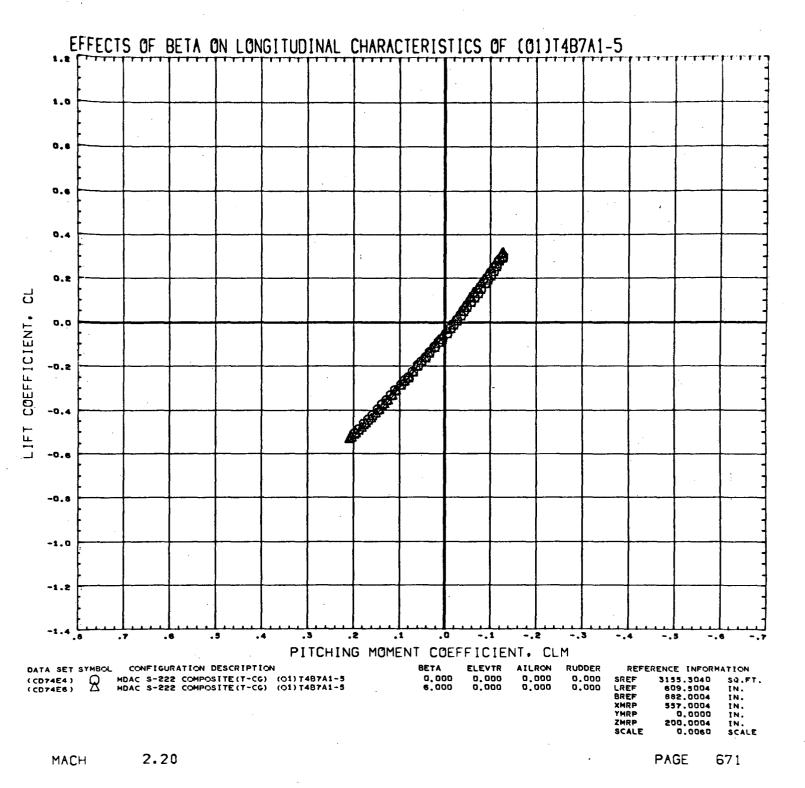


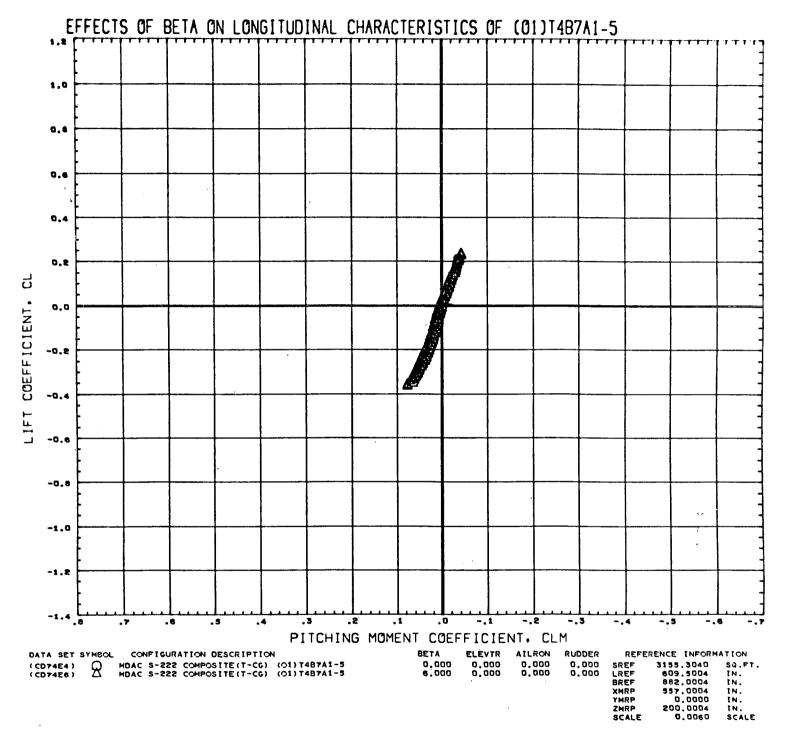
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MACH 1.09

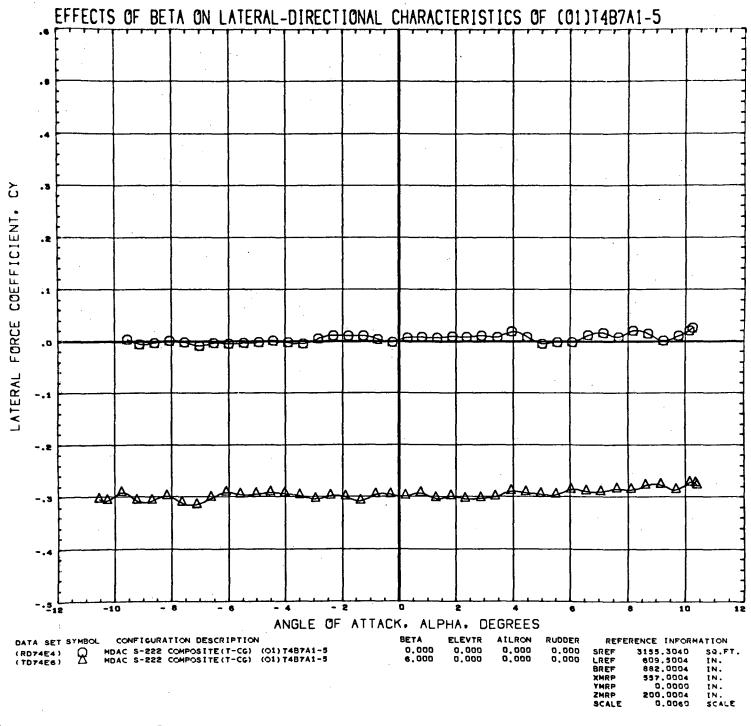




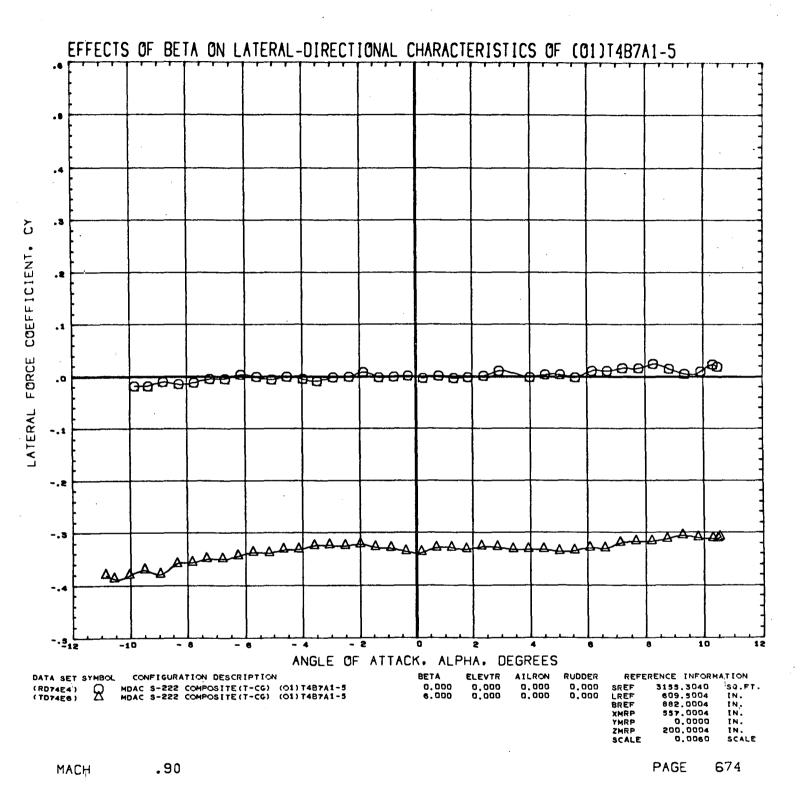


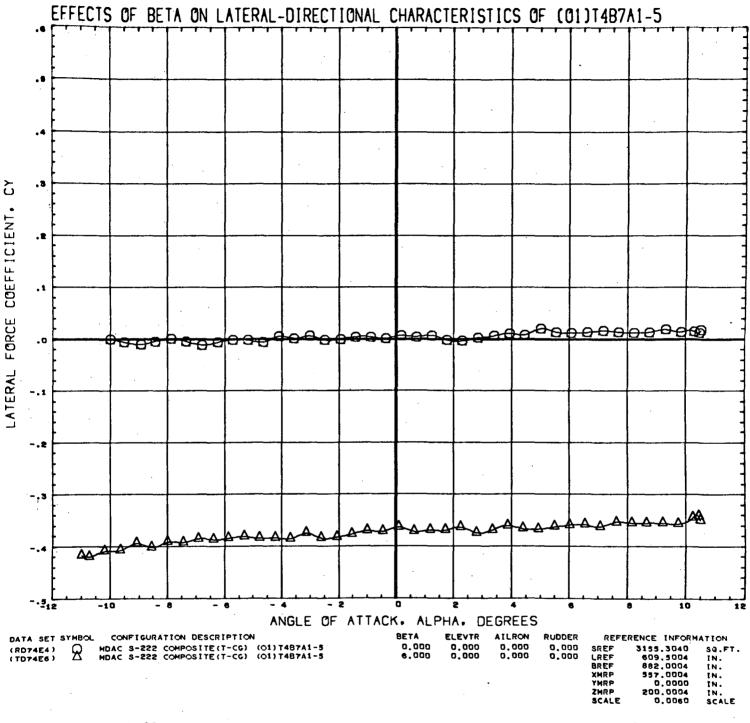
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4.47

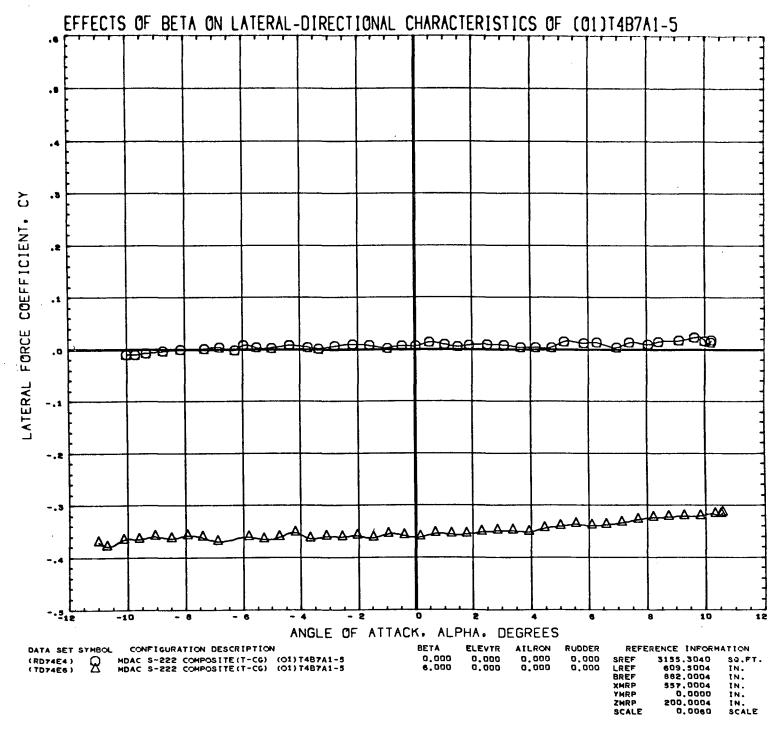


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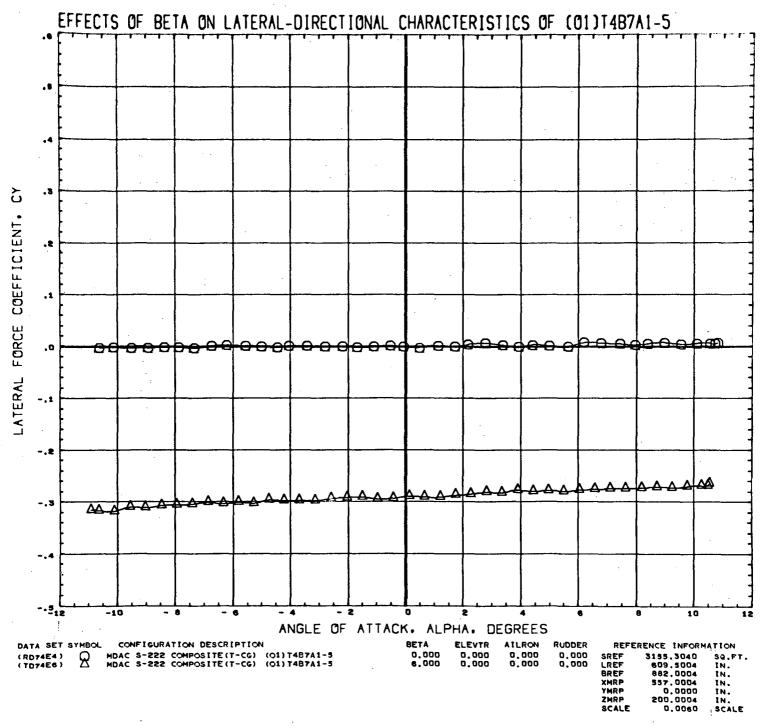




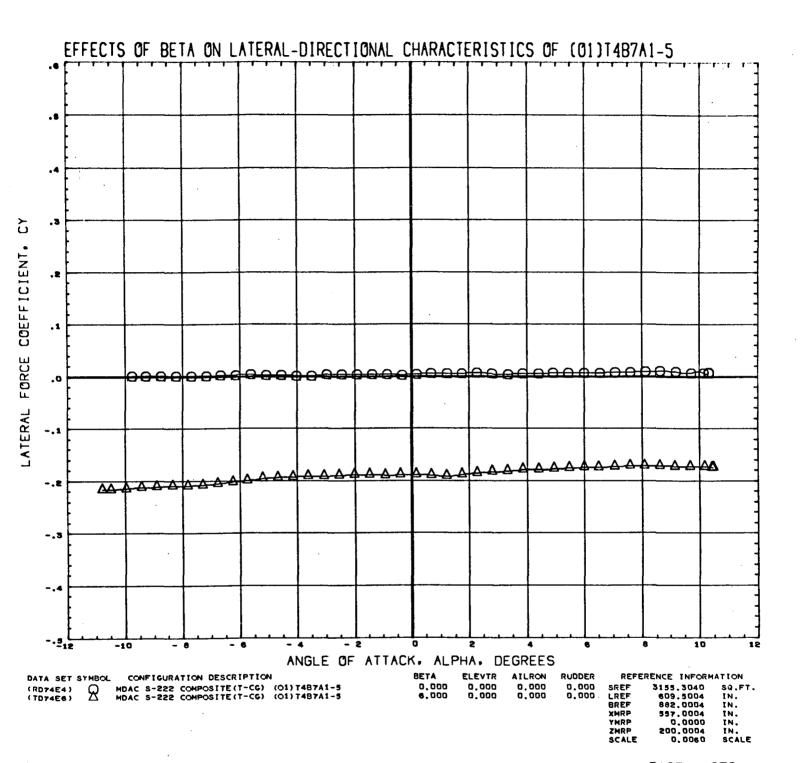
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MACH 1.51

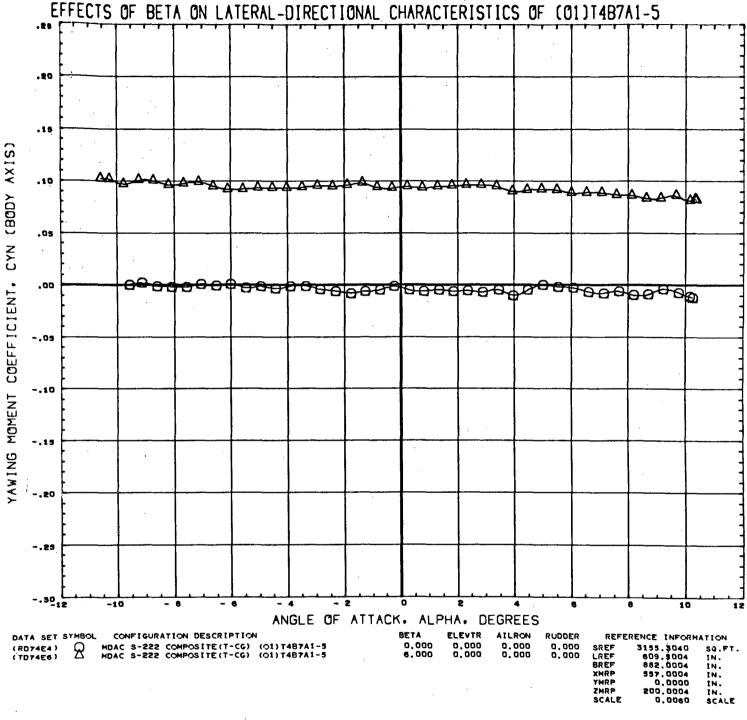


MACH 2.20



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MACH 4.47

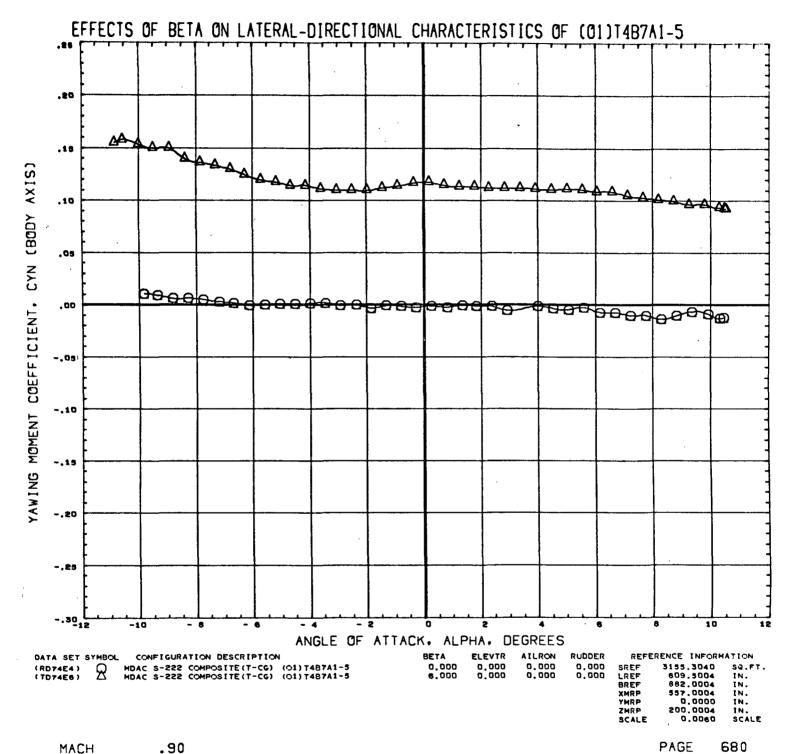


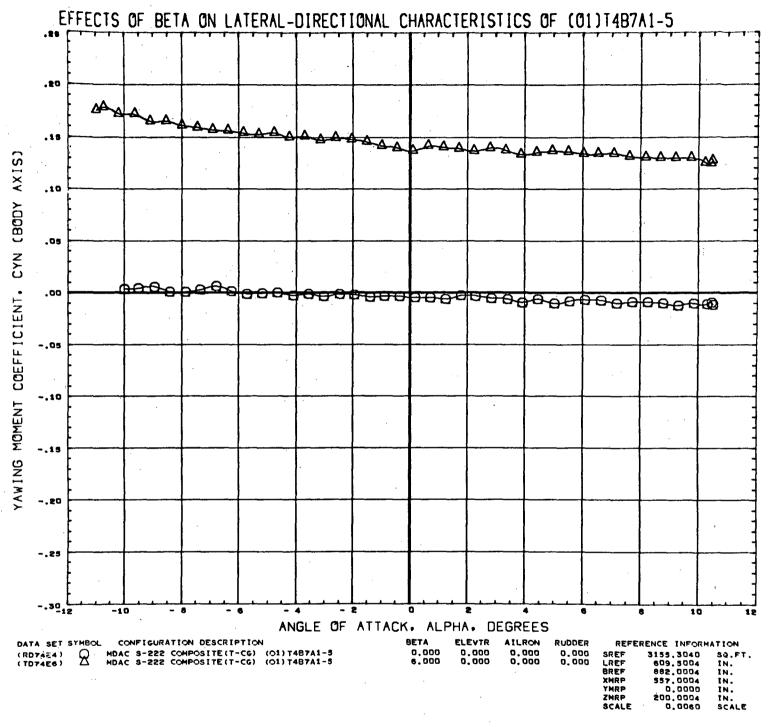
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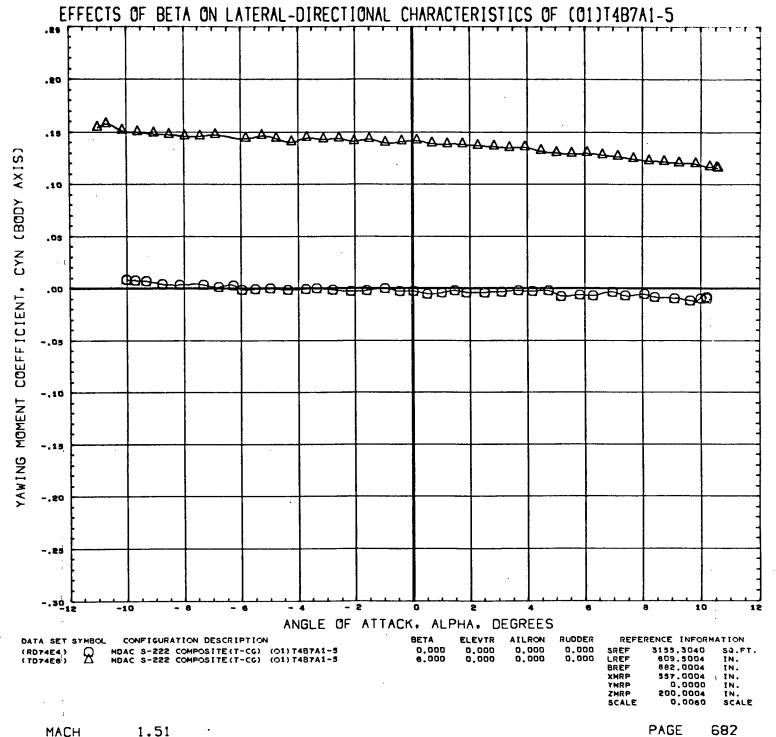
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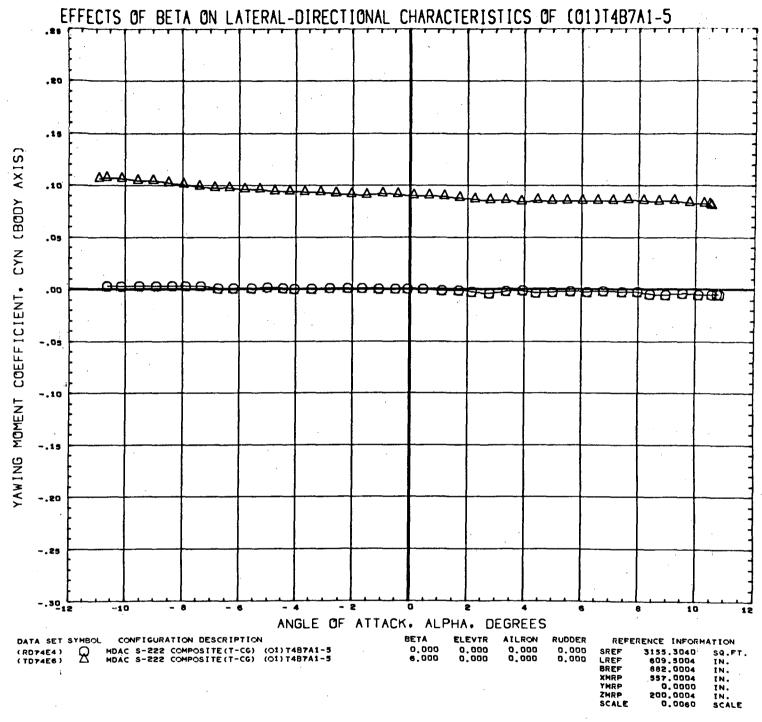




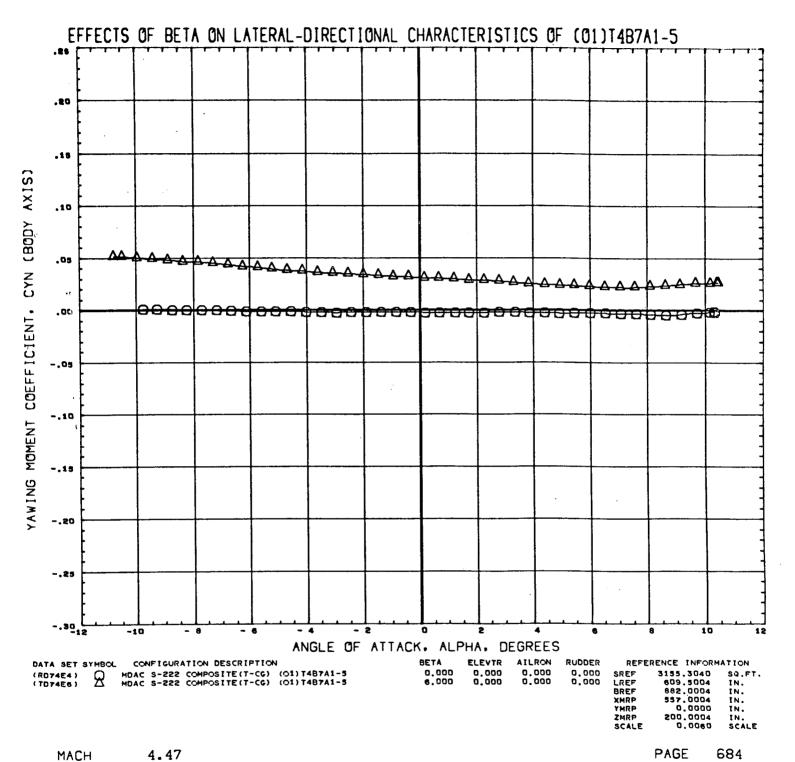
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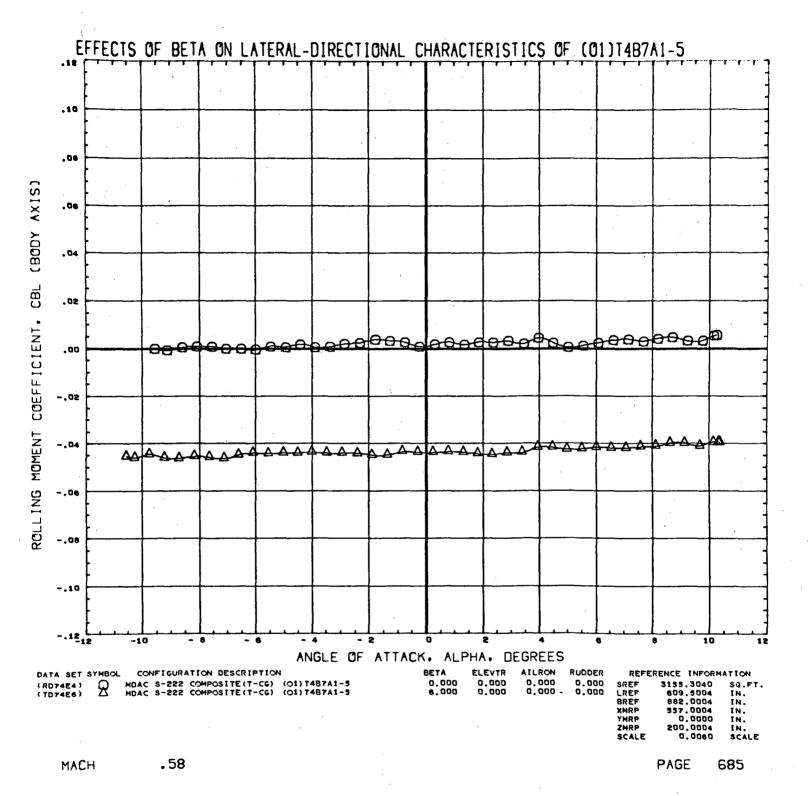


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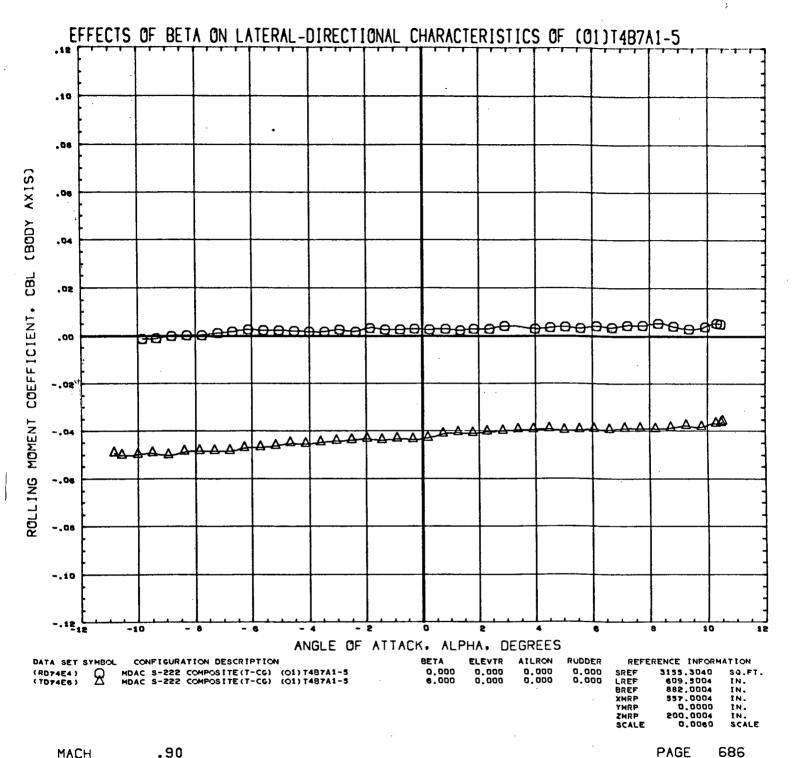


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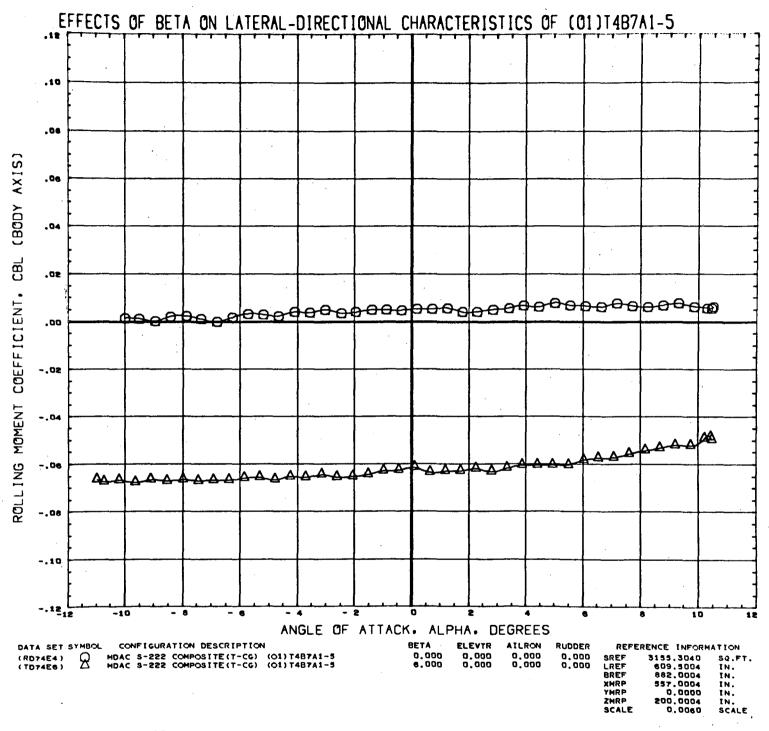




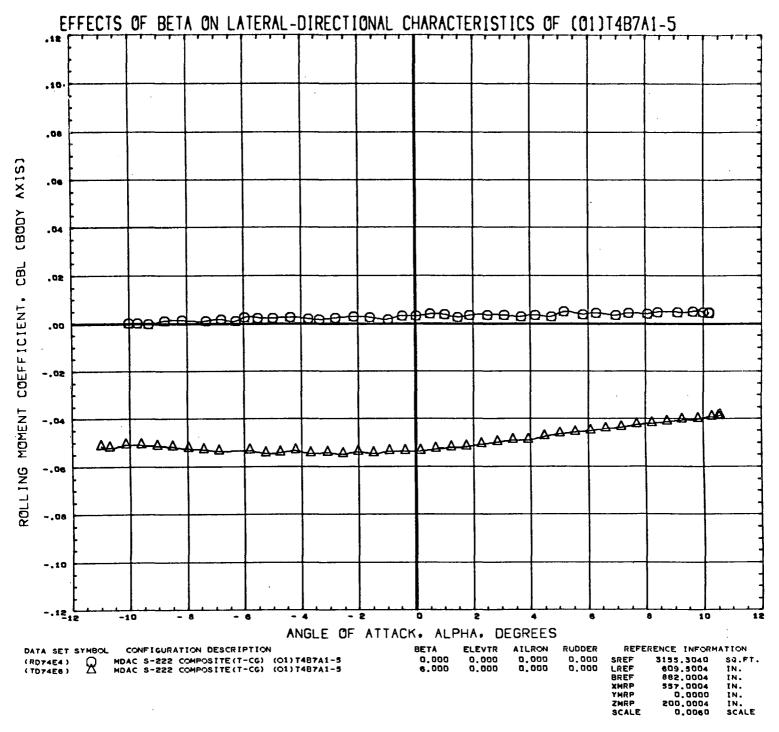
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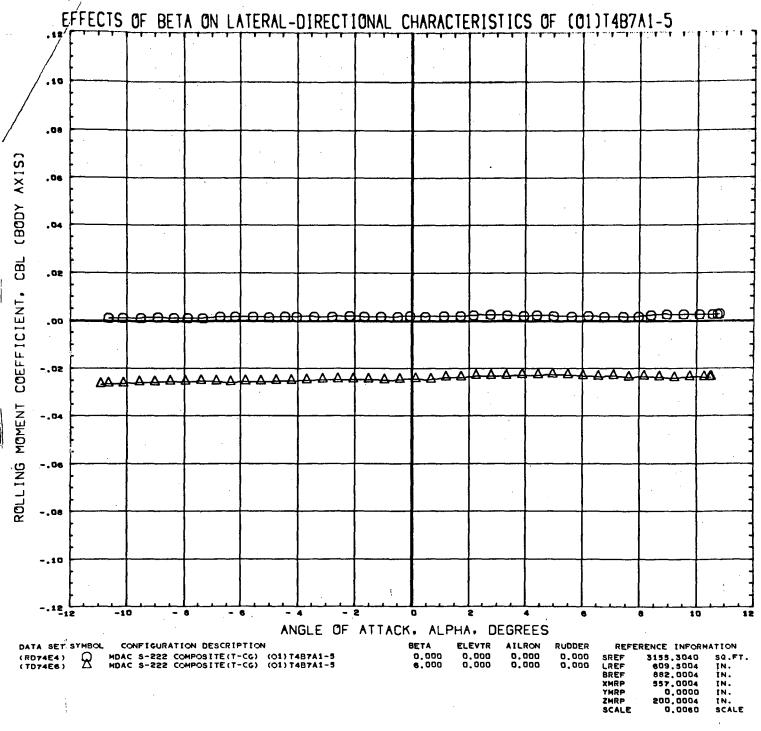


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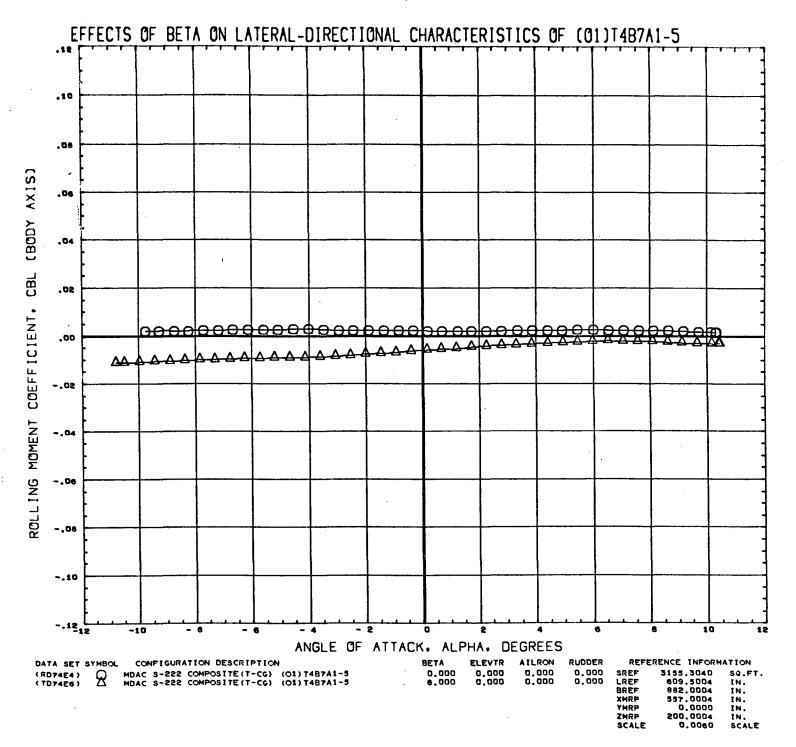


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MACH 2.20



MACH 4.47